National Library of Canada
Acquisitions and Bibliographic Services Branch
395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale du Canada
Direction des acquisitions et des services bibliographiques
395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file Votre référence

Our file Notre référence

NOTICE

The quality of this microform is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

If pages are missing, contact the university which granted the degree.

Some pages may have indistinct print especially if the original pages were typed with a poor typewriter ribbon or if the university sent us an inferior photocopy.

Reproduction in full or in part of this microform is governed by the Canadian Copyright Act, R.S.C. 1970, c. C-30, and subsequent amendments.

AVIS

La qualité de cette microforme dépend grandement de la qualité de la thèse soumise au microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

S'il manque des pages, veuillez communiquer avec l'université qui a conféré le grade.

La qualité d'impression de certaines pages peut laisser à désirer, surtout si les pages originales ont été dactylographiées à l'aide d'un ruban usé ou si l'université nous a fait parvenir une photocopie de qualité inférieure.

La reproduction, même partielle, de cette microforme est soumise à la Loi canadienne sur le droit d'auteur, SRC 1970, c. C-30, et ses amendements subséquents.

Canada

UNIVERSITY OF ALBERTA

NARRATIVE APPROACH TO SCIENCE TEACHING

BRINGING SOCIOCULTURAL AND ENVIRONMENTAL CONTEXTS TO SCHOOL SCIENCE IN NEPAL

BY

HRIDAYA R. BAJRACHARYA ©

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY

THE DEPARTMENT OF SECONDARY EDUCATION
EDMONTON, ALBERTA

Fall, 1995

National Library
of Canada

Acquisitions and
Bibliographic Services Branch

395 Wellington Street
Ottawa, Ontario
K1A 0N4

Bibliothèque nationale
du Canada

Direction des acquisitions et
des services bibliographiques

395, rue Wellington
Ottawa (Ontario)
K1A 0N4

Your file Votre référence

Our file Notre référence

THE AUTHOR HAS GRANTED AN IRREVOCABLE NON-EXCLUSIVE LICENCE ALLOWING THE NATIONAL LIBRARY OF CANADA TO REPRODUCE, LOAN, DISTRIBUTE OR SELL COPIES OF HIS/HER THESIS BY ANY MEANS AND IN ANY FORM OR FORMAT, MAKING THIS THESIS AVAILABLE TO INTERESTED PERSONS.

L'AUTEUR A ACCORDE UNE LICENCE IRREVOCABLE ET NON EXCLUSIVE PERMETTANT A LA BIBLIOTHEQUE NATIONALE DU CANADA DE REPRODUIRE, PRETER, DISTRIBUER OU VENDRE DES COPIES DE SA THESE DE QUELQUE MANIERE ET SOUS QUELQUE FORME QUE CE SOIT POUR METTRE DES EXEMPLAIRES DE CETTE THESE A LA DISPOSITION DES PERSONNE INTERESSEES.

THE AUTHOR RETAINS OWNERSHIP OF THE COPYRIGHT IN HIS/HER THESIS. NEITHER THE THESIS NOR SUBSTANTIAL EXTRACTS FROM IT MAY BE PRINTED OR OTHERWISE REPRODUCED WITHOUT HIS/HER PERMISSION.

L'AUTEUR CONSERVE LA PROPRIETE DU DROIT D'AUTEUR QUI PROTEGE SA THESE. NI LA THESE NI DES EXTRAITS SUBSTANTIELS DE CELLE-CI NE DOIVENT ETRE IMPRIMES OU AUTREMENT REPRODUITS SANS SON AUTORISATION.

ISBN 0-612-06182-5

Canada

University of Alberta

Library Release Form

Name of the Author: Hridaya Ratna Bajracharya

Title of Thesis: Narrative Approach to Science Teaching: Bringing Sociocultural and Environmental Contexts to School Science in Nepal

Degree: Doctor of Philosophy

Year this Degree Granted: 1995

Permission is hereby granted to the University of Alberta Library to reproduce single copies of this thesis, and to lend or sell such copies for private, scholarly, or scientific research purposes only.

The author reserves all other publication and other rights in association with the copyright in the thesis, and except as hereinbefore provided, neither the thesis nor any substantial portion thereof may be printed or otherwise reproduced in any material form whatever without the author's prior written permission.

H. R. Bajracharya

Kha 1 - 841-1, Tahachal 4
Kathmandu Nepal

Date: April 12, 1995

UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled A NARRATIVE APPROACH TO SCIENCE TEACHING: BRINGING SOCIOCULTURAL AND ENVIRONMENTAL CONTEXTS TO SCHOOL SCIENCE IN NEPAL submitted by Hridaya Ratna Bajracharya in partial fulfillment for the degree of Doctor of Philosophy.

Dr. Wytze Brouwer (Supervisor)

Dr. Walter D. Samiroden

Dr. Terrance R. Carson

Dr. Patricia M. Rowell

Dr. Allan E. Wheeler (External Examiner)

Date: April 12, 1995

A DEDICATION

In loving memory of my parents who gave me an experience of a loving and caring family of brothers and a sister and a direction to stride so that I could be fully human, to myself and to the society wherever I be.

And

To my eldest brother and my sister who sacrificed many of their personal desires, remained *Brahmachari* (committed unmarried) to make sure that all of us are able to stride in that direction.

ABSTRACT

School education is a new social paradigm in countries like Nepal where older narrative traditions provided a system of education that has delved its roots deep into the social and environmental milieu. This new paradigm of modern school education came with a science curriculum loaded with the curricular objectives of scientific skills and knowledge often unable to integrate and grow in the traditional social milieu. In Chapter 1, many problems related to modern school education in general, and science education in particular, in countries like Nepal are discussed. There an argument is presented for a need to make science education interact with social knowledge and other experiential knowledge of the students in a more constructive way, to instill among the students a science education which would help them gain both an understanding of the accumulated social wisdom and an appreciation of the knowledge and skills of modern science. Thus the central research question is: How effective is a narrative approach to science education in creating bridges between school science and the student's lived-in contexts?

The narrative approach was chosen as a means of bridging the science curriculum to the social contexts. As discussed in Chapter 2 and elsewhere, the narrative approach has increasingly been identified as a powerful and effective way of increasing the educational interaction between science and culture. Also, it is argued, that much social knowledge and wisdom are often embedded in the social fables, riddles, and other narratives, and that such social narratives help create a meaningful context for science

education. It was expected that student narratives would bring into the open many such social beliefs.

The contexts of the study in the actual school and social setting -- the limitations and the positive aspects of social narratives, the tradition, culture, and local economy are discussed in Chapter 3. There it is indicated how a number of physical, economical, and educational contexts limit the scope of modern school education and the possibilities of overcoming such limitations through the narrative approach are suggested.

The discussions in Chapter 4 and 5 and 6 illustrate the feasibility of using narratives as a means of bridging the student's social contexts and school science. This provides a positive answer to the central question of this research. Critical examination of the school situation and the role of the narratives are discussed in detail with the help of specific research questions. The research study, as reflected upon in Chapter 7, shows that the narrative approach to school science teaching is interesting, effective and useful in the present contexts and is also useful to sow the seeds of changing school science to make it socially interactive.

Acknowledgements

Metaphorically, I consider my research as a plant that could grow and flower in the form of this thesis because of a caring and supportive environment. My teachers, colleagues, friends, and family all contributed to ensure that pleasant environment. I wish to acknowledge them here.

My foremost gratefulness is to my Supervisor Professor Wytze Brouwer who helped me since the very initial period of my study here in the University of Alberta as a mentor and a pedagogue. He understood my potentialities and limitations that come in-built due to my coming from Nepal which is so different from Canada including the difference in language and culture. He has guided me throughout this study and in writing the thesis to make sure that it matched the soil (the contexts), got adequate water (substance), adequate light (studies) and warmth (attitudinal attention). He will always be in my Nepali conscience a venerable *guru*.

My gratefulness is also to Professor Walter D. Samiroden, a member of my supervisory committee who has always stood by my endeavor as another supervisor. His critical, crisp and practical suggestions have given me strategic confidence in conducting this research and writing this thesis. Grateful regards to Professor Terrance R. Carson another member of my supervisory committee with whom I have had my longest course interaction in the University of Alberta. I learned from him the beauty and usefulness of balancing critical perspectives and practically lived realities and a way to address such understanding in this research through an action research.

My grateful thanks are also due to Professors Heidi Kass and Patricia M. Rowell for their supportive ideas that helped refine my study. Professor Jim Parsons deserves my special thanks for his encouraging words and practical advice which I found very helpful to this research. My heartfelt thanks also to Professor Allan E. Wheeler of Brock University, Ontario, for reading my thesis meticulously and providing me with critical and constructive comments.

I feel fortunate to have many friends and well wishers who were always eager to know about my research and in natural conversations

exchanged ideas adding valuable ingredients that continually enriched this research endeavor. Thanks to them all. Here I wish to list those who helped during my thesis writing by providing critical and constructive comments: Pramod Shrestha, Roshan Chitrakar, Bidya Nath Koirala, Samira Luitel, Hemanta Raj Joshi, Kathryn Downton, Deep Kapoor, Linda Shultz, Christina Mader, and Silas Oluka.

My grateful appreciation to Centre for International Educational Development, Department of Educational Foundations (now Educational Policy Studies) University of Alberta for providing me the CIDA funded award that supported my studies at the Department of Secondary Education, University of Alberta. I must extend my grateful appreciation to the Canadian International Development Agency (CIDA) for the funds, the main source of energy that helped all this to happen. Appreciation is also due to International Development Research Centre (IDRC) for the funds provided to carry out the research in the field contexts.

My special appreciation to Dr. Madhav Mainali who created a strong bond between CIED, University of Alberta and CERID, Tribhuvan University, from CERID side. My heartfelt appreciation to Professor Kazzim Bacchus who helped consolidate this bond from CIED side. This bond created the possibility of this study which Dr. Madhav Mainali helped me get onto. My gratefulness to Professor Marilyn Assheton-Smith, present director of CIED and co-ordinator of the CIED Nepal project, who not only supported my initial award for three years but also extended supportive help in times of need. She has also provided academic help to my research in the development of proposal and designing of the study. Her personal inclination to help people from Nepal has a special role in making this study a success. My appreciation also to Mr. Wilfred H. Allan, Director Alberta International, for his caring love towards people from Nepal. He gave me an experience of confidence away from home which is one of the important factors for the success of this study.

I would like to extend my grateful thanks through Professor Ken Jacknicke, Chairman, Department of Secondary Education, and to the Department for providing me this opportunity to study here and also for providing me an assistantship when the CIED award term ended. It would

have been virtually impossible without this departmental support to complete this study. Also, the daily exchanges of smiles, greetings, taps on the shoulder in the third floor Education South corridor by the colleagues, the faculty members, and the staff have been important in keeping up my strength and spirit throughout my study period.

I wish to extend my appreciative thanks to the participating schools Gandhi Adarsha High School and Vishwoniketan High School, and the science teachers Akhil Koirala, Uttara Shrestha, Gauri Khwonju, Yeshodham Tripathy, Shanti Manandhar, Kamala Shakya, and Toye Raj Paudel who not only helped me generate information but worked with me sharing the joys and pains of trying a narrative approach through an action research. My appreciation also to Ganga Shrestha, science teacher, Nava Adarsha High School, for sharing the issues and possibilities of her teaching experiences. They all shared with me many of the ideas generated during the action research in the schools. And I shared with them many of the dilemmas of being a science teacher in an economically and socially constrained situation.

Finally I save this corner to acknowledge my wife whose joyful and caring accompaniment throughout my study period has been very inspiring for the successful completion of this endeavor. I am also fortunate to have an extended family back home in Nepal whose love and goodwill have always remained high as the Himalayas for both of us. The feeling that we have a home so loving and pleasant have always helped me to maintain a positive orientation in this study endeavor.

CONTENTS

Chapter I

SCIENCE EDUCATION AND SOCIAL CONTEXTS 1

A Critical Research on the Problems of Science Education 4

Economic Issues 4

Social and Cultural Issues 7

The Issue of Curriculum Relevance 10

Autobiographical Reflection 13

Research Focus 20

Chapter II

CONCEPT AND METHODOLOGY 24

Narratives in Science: The Narrative and Paradigmatic Aspects 25

Prior Knowledge and Storied Teaching 29

Narratives in Science: Research Questions 30

Research Methodology 32

Contexts and Concept 32

Situating the Study in the School Contexts 35

Action Research: Situating in the Contexts: 37

Study Scheme 40

1. Setting the ground work: 42

2. Generating teacher and student narratives: 43

3. Getting insights into the narratives and the stories: 45

4. A reflection on the research: 46

5. A Reflection on the Research Approach: 47

Duration 48
Delimiting and Limiting considerations 48
Conceptual 48
Procedural 51
Significance of the Study 52

Chapter III

NARRATIVE CONTEXTS 55
The Limitations and Positive Aspects of Myths 57
A Question of Knowledge and Proof 64
Festivals and Other Distractions 71
The Physical Limitations 81
The Traditional Expectations of Science Teaching: Another Limitation 89

Chapter IV

STORY TELLING IN SOCIETY AND IN SCHOOL 101
The Importance of Story Telling in Nepalese Culture 101
Importance of Stories in Education 107
Stories in the Classroom: Stories by Researcher 109
Chapter Summary 128

Chapter V

STUDENTS' NARRATIVE RESPONSES 132
Student Narratives and the Interaction in the Class 132
Social Context - Generated Narratives 142
Fridays in the School. 144

Group Discussion Generated Narratives 147
Narratives in the Students' Views 151
Teacher Narratives and Student Responses 154
Teacher and Student Attitudes to Narrative Approach 164
Chapter Summary 169

Chapter VI
RESPONSES TO NARRATIVE APPROACH 173
Teacher Responses 174
Sharing the Views on Narrative Approach 177
Some Initial Teacher Narratives in the Classroom 179
The Classroom Management and the Narratives Approach. 184
Constructing Narratives for Science Teaching 186
Narrative Contexts and Believability 188
Blending the Stories with the Classroom Discourses 190
A Teacher Reflection on Narrative Approach 194
A Summary of this Section 197
Student Responses 199
Stories are Interesting 200
Drawing Figures and Making Stories 202
The Non-Threatening Situations 205
Interactive Narratives and Student Preconceptions 208
The Narrative Approach and Exam Anxiety 210
Summary of this Section 216
School Administrator's Response 216
Summary of This Section 225

Chapter VII

REFLECTIONS ON THE RESEARCH 227

Constructing Narratives that Resonated with the Students' Experiences 231

Connecting Science and Social Contexts through Narratives 235

Narratives and the Science Content Requirements 238

Student Preconceptions and the Narrative Approach 241

The Importance of Action Research in this Study 241

Some Further Possibilities 244

A Conclusion 245

References 251

Appendix I. A Brief Historical Account of Modern School Education in Nepal

Appendix II. Glossary

Appendix III. Participating Schools and the Teachers

Chapter I

SCIENCE EDUCATION AND SOCIAL CONTEXTS

Science is a prolific area of knowledge that has been shaping modern understanding of the world as well as the course of our modern social, economic, and environmental developments. School education therefore emphasizes science as one of the most important subject areas. The aim of science education is often to bring the knowledge of science into society so that society would be able to appraise the wonders of the nature from science's perspective and use it for the benefit of society. The prolific development of science has, however, come to the underdeveloped countries like a forceful stream in a vast terrain of human possibilities. It could bring many changes, and affect the environment but not necessarily cover the whole world of possibilities. For example some of the traditional ways of health care (acupuncture, Ayurvedic treatments etc.) are yet to come under the grasp of science knowledge. Until the very recent past, many traditional societies such as those to be found in Nepal not only lived but thrived with vibrant ways of addressing the human desires and aspirations with their indigenous knowledge and perspectives. The argument is not against science knowledge but for being aware of how it has come abruptly, overwhelming the traditional societies, and the way its tremendous current of development has made it go deeper and further away from the social domains. The result: science education has become an ever expanding challenge in the schools of countries like Nepal. This context brings an

important question: How do we address the expanding science in school education?

This question has been one of the pre-eminent concerns of science educators over the past several decades. Some authors (e.g., Bruner, 1960; Kromhout and Good, 1983; Good et al., 1985) addressing the question "what is science education and why science education?" emphasized the acquisition and beauty of knowledge as primary goals of school science, while others (e.g., Bruner, 1971; Yager, 1984a; 1984b; 1985; Bybee, 1987; Fensham, 1988; Roberts, 1988) emphasized the need to make school science more socially relevant. Neither the understanding of science education as the development of knowledge nor the emphasis of science as a socially relevant undertaking has yet provided a clear conception about how science could be taught in classrooms in totally satisfactory ways. Nevertheless, the two arguments are not mutually exclusive and therefore the bigger concern is how to combine social concerns and science knowledge in a way that is suitable for school education.

The concern of making science suitable for school education has an additional dimension of problem in countries like Nepal where science education, as well as modern school education itself, is a rather recent development (see appendix I). In Nepal modern education was introduced only in the 1950s. It was introduced with an aspiration of achieving modern development; to transpose Nepal from a situation of backwardness in terms of modern technology and economy into a situation of technological progress and economic prosperity. Science education has usually been considered a forerunner or catalyst in this mission.

The spectacular technological and modern economical development of the West has provided substantial ground to build this image of science. It has also inspired countries like Nepal to develop or import the types of science education that looked more relevant to modern development. It was in this line that the Nepal National Education Planning Commission (NNEPC), soon after its inception in 1954, recommended applied science at the secondary level school curriculum (Grade 6-10, age; 12-16), (MOEC, 1985).

Over the past four decades Nepal has made several efforts to achieve 'functional science' in school education, but without much success. Instead, as the volume of science education in Nepal expanded, a shortage of science teachers, a shortage of science education materials, a lack of effective textbooks, and a disproportionately high failure rate of students in science examinations, became conspicuous problems. For these reasons an overall secondary school curriculum revision in Nepal in 1984 changed the status of science as a compulsory subject, to an optional subject at grades 9 and 10 (CERID, 1989).

However, this step came against the desire of most school communities and lay people in Nepal for whom science education still remained a hope for modern development, a hope to escape from the hardship of traditional ways. The demand for reinstating science as a compulsory subject at all grade levels came very strongly from parents, science teachers, and the progressive section of society. Consequently, in 1992, science education was reinstated as a compulsory subject at all levels of high school education. Nevertheless, science education in the Nepalese

school education context remains in confusion. The connection between science education and development remains a riddle not well understood in Nepal's social context. This indicates a need for critical articulation of the problems and prospects of science education in countries like Nepal before one can understand what might account for a better science education in such countries.

A Critical Research on the Problems of Science Education

In Nepal, the early 1950s marked an era of hope to develop socially and economically. Education in general, and science education in particular, was highly emphasized in this endeavor with the expectation that it would enhance socioeconomic development by training students to become innovative and skilled human resources. However, in a rush to develop science education many fundamental issues were, seemingly, not adequately or appropriately addressed. These included economic issues, sociocultural issues and issues of curriculum intents.

Economic Issues

In a country like Nepal, a lack of economic resources, a lack of well prepared teachers, and a lack of appropriate instructional materials are major problems faced in education (Shrestha, 1988; CERID, 1989; The World Bank, 1989). Most schools cannot afford to acquire even basic equipment such as microscopes and balances, or replace disposable materials such as batteries, chemicals, light bulbs, or risk breakage of materials like thermometers, lenses, test tubes and glass ware. All these conventional science education materials have to be imported. Therefore, science

materials, if there are any in a school, are often found in unopened packages on the dusty cupboards in an unused dark, damp and cramped room usually designated as the "science room" (Young et al., 1982). On the other hand textbooks serve as the curriculum guides and often are the only instructional resource available in many schools (CERID, 1989). These textbooks are centrally developed, produced, and subsidized so that they are available to students and are within their reach. They are passed on from one hand to the other; to generations of younger brothers, sisters, neighbors or relatives.

These problems have affected a variety of educational research and improvement projects in Nepal. For example, since the early eighties, the Science Education Project (SEP) in Nepal had intended to develop certain schools as resource/training centers to facilitate science teachers and the students of the adjoining regions materially, and to train science teachers in science education activities. The project also provided some basic science equipment (CERID, 1989) to some other schools.

However, the SEP programs, whether training of science teachers, or providing science education material to the schools, came in a set pattern for all the schools whether in rural or in urban Nepal. As a result, in the rural area where there are no proper storing facilities, many of the chemicals provided could not be stored properly nor be used in the classroom for the lack of support facilities such as water, sink, light, and safe places. Similar conflicts of the contexts and the approach were also to be seen in teacher training. In the rural area teacher training schools the procedures and precautions required in science activities could be explained but not practiced. There was little room for what the individual schools needed and

what they might not want. Science Education Development Units (SEDU) designed with the help of foreign advisors were built in many schools to provide exemplary science laboratories, instructional rooms, exhibition rooms, and modern residential quarters for the unit in-charges. What seemed overlooked in this approach were the facts that most schools in Nepal didn't have adequate space, that the concept of a residential quarter in a school compound lacked social contexts. Most people live in extended families with many family members sharing the residential facilities and also supporting each other economically and socially. Thus a home is more a permanent abode -- a very private space at family level. In the schools in Nepal where the buildings must come very near do not provide such environment. Nor the idea that the residential quarter for the working staff is a temporary public provision give comfort of a traditional residence. Also in many cases, schools are often at a distance from the community residence area and therefore such residential quarters are off the link from community. In Nepal, people live very near to each other socially, besides, communication and transportation facilities are not well developed in the country to suit such living. Consequently, the quarters as well as the other new facilities of SEDU were not fully used for the benefit of the schools they were built for. In summary, the SEDU buildings and the facilities did not blend with the school as well as social environments. The mismatch was further intensified due to the fact that:

- most schools in Nepal didn't have classrooms that could be used as science rooms;

- for many students it was difficult to pay even a subsidized school fee, or to buy textbooks, paper and pens, and other materials;
- in rural Nepal many students come to school barefoot some and of them have to walk more than two hours; and
- many of the students had to work at home helping with farm work, gathering fuel-wood, collecting water, etc.

Projects like SEP were not only unsustainable but also irrelevant to the current contexts of school education in Nepal. They have failed to enliven science education with the concerns of the people they were developed for, and like in most other endeavors, the materials that it provided to the schools have basically ended on the "unused shelves."

Social and Cultural Issues

Another issue seems to lie in the fact that science education has remained unable to establish a meaningful relationship with the societal contexts in countries like Nepal. Except for the joy and wonder of getting an explanation for the scientific riddles that did not really matter to real life experiences, science education has remained isolated from society. Science often did not recognize the value of traditional society, and often regarded it as irrational. Traditional society, on the other hand, often did not recognize that science had much to do with its own beliefs and values. For example, in Nepal, school science never discussed the reasons why there was an annual ritual for cleaning water wells at the start of the monsoon season, for example, or why people lowered oil lamps in deep wells to see whether the custodian deity would let the cleaning person enter the well, despite the fact

that scientific explanations for these rituals were hard to spot. In the gesture of adoring water from any natural source as pure and sacred holy water (Ganga Jal), believers in the country drink it and sprinkle it on their body no matter how visibly unhygienic it might look, or what contamination a microscopic observation might reveal to those persons who see from science's perspective. Schools are still closed on days when solar or lunar eclipses happen, so that the students can mourn and take purification baths with their families, while science lessons treat eclipses as mere phenomena of shadows, and remain silent about student activities during the eclipses.

Part of the reason traditional knowledge is not easily accommodated into science, or science into tradition, lies in the difference of language between the two domains. The language of traditional knowledge is rather accommodating instead of contesting. For example, how rain is made has several contradicting explanations all taken alternatively or together without feeling a need for contesting out. Thus sometimes it is Naga raja (King of serpent-like beings) who is thought to be the custodian of rain, other time it is Indra the king of the heaven who is supposed to be the custodian. Speculations whether mythical or empirical, contradictory or not, manage to coexist in traditional knowledge. For example the controversial perception of the snake as being a form of Naga, and also separating snakes from Naga with a myth that Nagas are superior beings who can transform from one form to another including human form. This particular myth leaves people to decide on their own whether to treat a snake as a Naga or as a snake. Sometimes, people may be heard of knowing clues of when and how to separate a Naga from a snake: snakes have a mean looking tail and head

pointed and crooked whereas Nagas have beautiful uniform color, bright and sparkling eyes, and a rounded tail. Consequently, traditional knowledge seems to be an irrational mishmash of stories from science's perspective -- mundane, mysterious, complex and almost invisibly interwoven with everyday life.

The language of textbook science, on the other hand, is represented in such a way that it does not allow uncertainty to appear in the conduct of scientific discourses. Ideas that intend to explain similar phenomena are expected to compete and the weaker ideas must be rejected(Popper, 1969). Scientific fact should appear as objective and actual, a representation of "things as they are." Although science concepts are in many cases conjectured tentatively, the language of science puts them in a hierarchy, thereby almost imparting to them the status of truth: Relationships between concepts that are 'proven' to represent the observations are called principles and laws; speculations that have been empirically supported, fit all known facts, and have no reasonable rivals, are called theories. Principles and theories are excellent stimulators of the imagination, but they often obscure their revisionary and tentative nature.

One of the powers behind science's authority over material knowledge is its capability to make models. Scientists can build models to reduce the whole gamut of objects and processes to a manageable form. They can watch the behavior of the model, tinker with it, and then make predictions about how planes will fly, how the economy will move, or how a protein chain might be constructed (Judson, 1980). Although most traditional knowledge also makes predictions and constructs models, traditional

knowledge is considered childish or irrational by proponents of modern progress.

In the formal world of education, traditional knowledge has been forced to retreat because of the powerful trend of modern development. The people who hold traditional knowledge are often marginalized without an opportunity to reassess science in view of their traditional knowledge. In many cases, traditional knowledge is shut off without adequately addressing the question. How can the rationality of science relate to the wisdom embedded in traditional knowledge?

Modern development and application of science by powerful countries add to the reasons that science "has more authority" than traditional knowledge. After the onset of colonization, colonizers often used science and technology to subdue the natives. It is no mere coincidence that the world economic and military powers are still using science and technology to subdue and "civilize" the whole world in their terms. The ever proliferating technology and material products that have affected not only human life but almost all the life forms conceivable on earth are powerful means to scare and impress the humanity to submit to the science's way as it has developed.

The Issue of Curriculum Relevance

Overcoming the problems of development and modernization has been a central enigma of science education in countries like Nepal. Most of the problems are basic in nature, such as the problems of poor sanitary conditions, lack of healthy drinking water, acute shortages of energy, lack of transportation, lack of adequate healthy food, and lack of improvements in

the technologies of the traditional professions. However, education in general, and science education in particular, have remained indifferent to the problems; they neither reflected these problems in their curriculum content nor provided a way to address them in other forms. Rather, the curricula often appeared tacitly to keep the situations as they were.

In many developing countries, there were no traditional education systems that matched modern school education at the time it was introduced. For example, the traditional literary education that existed in Nepal prior to the opening of modern school system, was exclusively limited to the intellectual and elite classes (castes). The modern school system was a more democratic option. However, because of the absence of contextual connections between society and education, a dilemma was created: the dilemma of "the world of the educated, or privileged" elevated from the "larger world of the underprivileged masses"(Baudrilard in Hebdige, 1988). It inspired a dominant concern of education: how to get access to the "world of the educated"; to jobs and to power.

Sirisri (1986) illustrates such concern of modern education to get personal elevation to a world of ease and abundance in the contexts of Thailand. In her thesis of an interpretive study of whether the current science program in Thai school was relevant to or in the context of the needs and the characteristic of the Thai society, she writes:

> The Thai people place a great deal of trust in education and have mythologized it. They believe that education is a path to higher standard of living, and that it can provide them with a convenient life: light work (free from physical labor) and a modern house. The parents expect their children to grow up and become people with position and authority, such as government officials or other white collar workers. (p.10)

Since the purpose of education is to get elevated to a different world, the world of ease and prestige, those who are educated do not or cannot go back to the mundane world to assume various productive roles. Modern education instills in a person a different language, a different rationale of life, and different aspirations. Consequently, the educated person needs a modern job. This view has created a serious job crisis and much unemployment in many countries like Nepal. In the subsistence agricultural economy of such countries, with the limited government jobs being filled, where do educated people fit? Because of the skills and the education they have learned, they have no 'charmed place' in their home country, many third world intellectuals, especially scientists and professionals tend to move out of their country to seek places in the developed countries. In other words, through the imported educational system, the third world citizens who might potentially be powerful agents for change in their home countries are psychologically removed from their country, having lost their sense of belonging. This issue of curriculum relevance reflects a crisis of science education in the developing countries.

The issues of economy, social irrelevance and curriculum intent, however problematic, cannot produce an overall rejection of science. Science has generated powerful ways of enhancing our perceptions and overall capabilities. Therefore the issue of science education should be reviewed in a different way: science, not as problem but as a new possibility. The orientation of school education ought to make it enjoyable, friendly, and useful to the society at the level at which the society currently exists. This

study is an endeavor to search for such possibilities. In the following section, I intend to reflect on my experiences with this in mind.

Autobiographical Reflection

To begin with, I came to Canada for my graduate studies with a fuzzy dream that someday Nepal would be a modernized country. And I thought, a good science education is required to shed many of its problems of underdevelopment. I believe that this thought was not my isolated contemplation, rather it was a reflection of a national aspiration. As a Nepali science educator, I was given a chance to pursue higher education in a prestigious University like the University of Alberta with an anticipation that inspired my own objectives and dreams, to develop a science education that would be relevant to our developmental needs and aspirations. Several years later I find myself looking through critical windows into those objectives and dreams. And I find myself asking: is modernization a mirage on our horizon? Will it be a fruitful possibility to pursue modernization in the social and environmental contexts of Nepal? Can we reach the material and technological stage of developed countries without exhausting what we possess? Or is it even necessary and desirable to move in that direction?

I struggle to retain a hopeful dream -- after all, what is my study for, if not to understand my own situation and to reconstitute it for a better future? Like the traditional way of taking "koseli" (a gift) when visiting home from a far away place (usually a pilgrimage), I was tempted in thinking that I must bring something to take back to Nepal from this, my research mission. A mission in which I consider this learning center as a sacred place where

activities take place to better understand the world, to make this world a better place to live in.

As I meditate on something to take home, glimpses of people, places, beliefs and values from my lived world interweave into a story that represents my living in Canada during this study period. The story, however, becomes unfocused as I try to re-identify my fuzzy self: as a science teacher in rural Nepal with all its limitations, or in urban Kathmandu where the problems of schooling are somewhat more manageable; as a science educator in an urban university campus; or as a researcher trying to sort out the problems of science education in a situation of underdevelopment? Imagining myself in these various roles creates tensions related to these different aspirations and limitations. Although these roles, aspirations, and limitations do not represent present realities, they are necessary to envision a world of future possibilities for Nepalese science education. Such envisioning animates thinking and action like walking in a world of virtual reality -- a reality constructed in my mind. Here I remember Borgmann's(1992) argument for the impossibility to be in a real reality and therefore a need to focus our living reality on to the immediacy of our lived world over against an 'objective' reality constructed on homogeneity, instrumentality, and objectivity. And I reminded myself that the bringing of "koseli"(gift) to my society, cannot be constructed apart from those for whom it is intended, rather, it has to be constituted in the immediacy of the reality to which I will be bringing the "koseli".

In a critical reflection, modernization may be a rather confusing notion, questionable on the grounds of feasibility, sustainability, and

desirability. Nevertheless, the main goal of education in Nepal remains to bring modernity and development. Perhaps, now what is more important is to articulate modernity and development in a different way, in the contexts of the social, cultural, economical, and environmental realities of Nepal. I still believe that my focal objective will be to work in developing a science education that will be easier and more interesting to teach and learn, and that will be more meaningful in the social and environmental context of Nepal. However, I now also believe that I should seek ways of improving science education from within the situation where it has to be developed, rather than contemplate on a theoretical plane only. Because I have been here, my experiences are enriched; because I have engaged in the various academic pursuits, many dimensions are added to my perceptions. These have culminated in reconstitution of my own reflection on my experiences in Nepal. Perhaps this way of personal reflection on our own experiences to understand our situation better, and to imagine for realistic changes is something which is better "koseli" to take home.

As I reflected on the nature of science education in Nepal, I tended to recollect stories and concerns from my experiences as a young student. One story from my school life as a student that often comes to mind:

> *When I was a junior high student, a favorite pastime of ours was to project film clippings from the old movies that we bought a piece for a "paisa" (like a cent). To project the film all we needed was a hollowed electric bulb filled with water, a piece of mirror and a room which could be made fairly dark and into which a beam of sun light could be reflected in from outside. A room with dark and heavy curtain and adjacent to sunny open place from where we could reflect sunlight with the help of a mirror was our favorite place. Usually, we had to play this, like most other games, while hiding from adult*

members of the family because they didn't seem to like us wasting our time in such play. For them, reading and writing were the only important things for students like us.

One afternoon while playing with the 'projector,' we noticed some weird worm-like shadows moving on the screen (wall). We could see them much better without the film clippings. Somebody from the crowd said: "They are small worms in the water in the bulb invisible to our naked eyes." Suddenly there was a commotion: "Where did you collect that water?...Bring a sample from the well, from the drain by the side of the well, . . ." We thought that we had made a serious discovery and we felt as if we were scientists.

We were still talking about our discovery in our 'Chowk'(a common court yard) in the evening. Someone suggested: "Maybe we should put some potash in the well." Another asked: "What is potash? What does it look like?" An elderly lady, who often sat on the verandah of her house watching us play for hours, probably overheard us. She responded loud and clear: "Hey, don't you dare put anything in the well! It will aggravate 'Naga Raja'(the Serpent Deity) in the well." Dabbal Dai, a self declared Chowk leader, suggested, without looking at us from his cutting table in his sewing workshop, that we wait until 'Sithi Nakha'(the annual well cleaning ceremony). The next day, early in the morning, a 'Kalash'(special offering for the 'Naga Raja') was already there on the rim wall of the well.

Later that day, as punishment for "playing" in class I had to stand up on the bench in the science class, my film clippings confiscated, and the 'eye-glasses' (lenses) taken by the teacher until the end of the class. My proud feelings of being like a scientist was soon decimated. I had spent all my tip money, accumulated doing grocery shopping for my home, to buy the 'eye-glasses'. I had been thinking about making a slide projector with the lenses. I had seen a sketch of how to make one in a book (not the textbook). In class we had been reciting the passages in the text again and again; I could do that without looking at the book when I had them memorized already. I should not have played with the lenses and the film

clippings while the class was running, but I guess I would be doing something else, anyway. Usually, the teacher would have never come that far to the middle of the class, moving uncomfortably through the narrow passageway, to check us whether we were really reading the book.

Nevertheless, it had been fun playing with the 'eyeglasses': "You can project the distant things on the other side of the window onto the wall.". "They are colorful and upside down." Many of my class fellows had never seen such things, though we had already read our chapter on lenses the past month. Many of them didn't even know that those film clippings could be projected, like the cinema in the hall, using a simple hollowed electric bulb. Many of them wouldn't believe that there could be worms in the water that we everyday used, and that they could be seen that simply. But who seemed to care?

The story makes me wonder: Could my childhood interests and enthusiasms have been addressed in a better way in that classroom situation? My grade VII Science textbook did mention different micro-organisms that live in water, but would anybody in my home and community bother about the 'worm story' without the kind of discovery we made?

What would have been the reactions of the science teacher and the other students in the class, if I had related to them the 'Chowk' conversations, particularly about the "Naga Raja?" Yet, I believe there were many students as well as the teachers who might have heard such stories sometime, somewhere. Most importantly, would there be anyone who would have taken us seriously if we had brought ideas from science class to the community, or vice-versa? I guess, we would be simply reminded to study hard, get good grades, get higher education, become a 'big' man ...

Didn't I reflect on those experiences as a teacher? Yes, but they seem more relevant now in anticipation of research than in the time I was a

teacher. My prominent concerns, at that time, were to keep the students interested and concerned in class so that they could be successful in the exams. I could bring in contexts as a strategy to arouse enthusiasm and interest in the students, but such activities were brief -- only to break the mood. It was always urgent to return to the serious business that seemed more natural in the classroom: note giving; explaining terminology; showing ways of solving problems, etc.

There was not much time to talk with the students in the classroom and to address their individual tastes and priorities. When I recall some students who were talented in other areas than science, I felt sorry for them. Sajani was one such student, especially good in biology, geography and arts. In grade six she had a lot of enthusiasm about science. However, in grade eight she failed science. The reasons were that she could not work on science problems and on derivations of formulae, and she hated to memorize laws and statements. Also, her ability to draw good pictures, write essays and stories did not contribute much in science. She had once argued what was wrong in saying that earth is a magnet, a special kind that attracts all things, that is why things fall back to earth. The textbook answer was just that it is called gravitation. No discussion of the differences between magnetic bodies and gravitationally attracting bodies was encouraged. I cannot recall myself asking "why" many times at that age. Perhaps the way science was taught eventually gave her a 'science phobia' by overwhelming her with lots of lifeless statements, laws, and problems.

I wonder, if there were other alternatives, but at that time I did not see much choice: I had to complete numerous lesson units to prepare the

students for the exams. The exams were of concern not only to the students, but also to the teachers and the principal. A poor exam result could implicate the reputation of the teacher and of the school. A high failure rate might also mean the loss of a job by the teacher in whose subject the students fail most. Moreover, the school might face cuts in government grants if it did not meet the minimum pass level.

There was no space where I could have provided the experiences of science activities to my students. Even demonstrations of science activities were difficult and often did not seem to have helped the students in their 'learning.' Besides, an experimental approach could even be a risky thing to do; it would not only interrupt the usual teaching approach of the classroom, but might disrupt the whole normal school activities, due to the noise associated with the experimental group activities. The overcrowded (usually over 70 students) classrooms, narrow and dark classes with rows of desks and benches fixed to the floor, the proximity of other classes, the lack of planning time for teachers, all contribute to rather rigid classroom practices in Nepalese schools.

Perhaps if there were no grade boundaries I could have taught all the topics in a more interesting and meaningful way. Perhaps we also needed different types of evaluation that were more flexible and could motivate students in different ways. Sometimes, such wishful things spilled out in casual conversations in the staff room during leisure times, but as soon as the bell rang for our next class, we had to pick up chalk, duster, and the textbook, for the next 45 minutes. The routine work continued although we did not believe it was a good practice. Something kept us constrained to

follow the traditional old classroom practice of chalk and talk whether or not it made a sense in our lived world.

The issue of rigidity of school structure was felt not only by teachers but also as research and development workers. Unless it was in a non-formal educational setting, the research and development activities took for granted the existing school system as the basis of the programs. The programs often attempted to fix the problems that surfaced in the classroom. Thus, the problems of teaching in the crowded class, the lack of science education materials, the lack of social relevance, exam-centered education, etc., formed the central issues, and irremovable restrictions, of most educational research and development programs. In our research center, usually, we developed model materials and methods and tested them in the classrooms, or talked about curriculum reforms, physical facilities and classroom size. However, in practice, these materials could not go beyond experimentation in some classrooms; after the experimentation, the material and method would usually end up in the reports. The practice of science education remained unchanged as ever before.

Are there ways to enliven science education in Nepal so that it could respond to the interests of teachers and students? Are there ways to bring social contexts into the science classroom so that science classes could be made more relevant to day-to-day life? Can traditional classrooms evolve to address these questions?

Research Focus

The issues discussed above portray the science education in the countries like Nepal to be in a deep crisis. The crisis arises because of a lack

of social relevance, a lack students' and the teachers' lived contexts, and helplessness in being driven by the enigma of modernization. Obviously, there is a need to address these issues, to develop a better science education in such countries. In countries like Nepal, there is a need to change the approach to science education to make science learning more meaningful. The question is: How can this be accomplished given that any change has to start from the current situation with all the problems, limitations and prospects of today? This question is central to this study.

One way to address this question is to articulate what problems and prospects are there in bringing social and cultural issues into the classroom. A study by Mahapatra (1991) to identify the persistent effect of sociocultural concepts and rituals, as inherited by pupils, on their understanding of solar eclipses, in the Eastern region of India, has some important implications in this regard. Mahapatra's study showed that the sociocultural concepts and rituals about solar eclipses have generated certain alternative conceptions, which were quite resistant to extinction, among the students. For example, an appreciable percentage of the students believed that the devouring of the sun by 'Rahu' is the basic cause of an eclipse. And the students tended to defend the traditional belief using their alternative conception as the following interview dialogue indicated:

> Teacher: *Why do you think that one should not take food during a solar eclipse?*
>
> Pupil: *Because during those period germs and viruses increase in number.*
>
> Teacher: *How do you come to this conclusion?*

> Pupil: *It has to be so because the sunlight is so weak during the solar eclipse.* (Mahapatra, p. 435)

What makes the study more interesting is that the students involved in the study were high achieving senior high students from a highly reputed school in an urban city Also, the parents of all the selected students were university graduates. The textbook on general science for standard VI published by NCERT, India, contained solar and lunar eclipse as one of the units. In this unit the solar and lunar eclipses are explained respectively as the phenomena of the shadow of the moon on the earth and the shadow of the earth on the moon. The teachers usually followed the textbook faithfully. In a few cases the teachers even supplemented the book with models.

Jegede and Okebukola (1991) have, similarly, pointed out that contradictory sociocultural beliefs (such as mating in daytime leads to an albino) hindered biology learning by the school children in rural Nigeria. Their experimental study indicated that instruction in science deliberately planned to include discussion of sociocultural views about science concepts engendered positive sociocultural attitudes towards the study of science.

Mahapatra as well as Jegede and Okebukola argued that the students' short exposure to science compared with their long exposure to sociocultural beliefs were the reason behind the result. They suggested a need for bringing the sociocultural beliefs to the classroom for discussion. However the question is: how would a student be able to separate myths from the facts, given that both come from texts, or sources that have legitimacy in the society. Both sources appear to have no consideration for what students

believe or what stories they make. Nevertheless, what difference would it make whether it is Rahu or the shadow of the earth or moon? Cannot Rahu be interpreted as the shadow?

These studies have opened a small section of the problems that underlie the science education in the sociocultural contexts where science is not only a new, but also an alien institution, and where traditional ways are influential factors in understanding the lived world by the students, the teachers, and the whole community. The studies helped to reveal more issues: what do we expect from students from their learning of scientific concepts? Do they need to disown their perceptions of the world based on their social beliefs, customs, and rituals to learn science? Can school science establish a friendly dialogical relation with the traditional society, or can science blend with cultural beliefs and conceptions that have enriched our social life through interesting customs and traditions? Studies such as those concerning the usefulness to science education of personal history of scientists (Brouwer and Singh, 1983), and others concerning students' personal stories (Martin and Miller, 1988; Martin, 1990; Martin and Brouwer, 1992) indicate the importance of personal narratives in school education. The main focus of this study is on the linkage of school science learning to the social and environmental contexts through narratives.

Chapter II

CONCEPT AND METHODOLOGY

In Chapter 1 the view that school science education in countries like Nepal could not develop in a way that could blend with the local contexts was discussed. One important reason behind this is the way science is perceived as a pure and rigid rational logical endeavor beyond the reach of the local ordinary discourses inherited from the cultural traditional past. Although many argumentative evidences show that science is the cumulation of personal endeavors of individual scientist, who like any other normal human beings, have both potentialities and limitations, science education still often purports science to be absolute truth. With this image it has become a techno-icon in school education and is presented in the form of a ritual, a ritual in the making of a "scientist." In the present contexts, it is not only the other logistic problems of school education that is making science education a source of frustrating problems. In fact the bigger problem is this lack of rapport between the various contexts and the scientific knowledge that would relate these various contexts. How do we address this problem? Is there a way to make science accessible to the local common sense and vice versa? Chapter 2 is dedicated to searching an answer to these questions and also to find a means which could be considered for a serious study in the actual school situation.

Narratives in Science: The Narrative and Paradigmatic Aspects

Understanding what science is and how it is done remains an illusory problem to science education even today. However, developments in this field do indicate that the way science is often viewed -- objective, logical and rational -- is often not the way it really is. Thomas Kuhn's (1970) theory on science's paradigms has put forward strong arguments that it is impossible to explicitly articulate anything like a common method, or a set of rules, or characteristics of doing science. Kuhn suggests instead that the identification of problems, the formulation of explanations and the criteria of evidence do not depend so much on rules, but on the existence of a common paradigm, a set of common beliefs that are only in part based on experimental and observational evidences. Following Kuhn's suggestion, it becomes obvious that science endeavors involve scientists' personal judgments, and the support of the scientists' community almost similar to that in any other social and political communities.

Although scientists and philosophers of science have now recognized the impossibility of describing scientific endeavors in terms of a set of rules, school science mostly continues to adopt non contextual "scientific concepts", "scientific rules", and "scientific methods." This makes school science give an impression not only to the students, but also to the teachers and society in general that scientific knowledge can be attained by explicitly following a set of scientific rules. Merken (1984) argues in the introductory section of his book "*Physical Science with Modern Application*" that the image of science as self testing, self correcting and objective needs to be changed to give more realistic image of science as a human endeavor that

encompasses complex aspects of human approaches; beliefs, intuition, trial, etc. Such realizations in science education of a need to change the perception of science as objective and rational as is often portrayed in the school education lead us to a new dimension -- the subjective aspects of science, how the people involved shape the scientific endeavor and how it should be addressed in education.

When referring to subjective aspects of science, Polanyi (1968) comes at the forefront. Polanyi argues that it is the depth of individual beliefs, and passionate commitment that takes scientists to the course of unfolding of scientific knowledge. Polanyi (1968) says:

> The excitement of the scientist making a discovery is an intellectual passion, telling that something is intellectually precious and, more particularly, that it is precious to science. And this affirmation forms part of science. (p. 134)

Polanyi argues that the discovery of objective truth in science consists in the apprehension of a rationality that commands our respect and arouses our contemplative admiration. Such discovery, while using the experiences of our senses as clues, transcends this experience by embracing the vision of a reality beyond the impressions of our senses, a vision that speaks for itself in guiding us to an ever deeper understanding of reality.

Polanyi recounts how a scientific theory could become reduced, in the modern mind, to the rank of a convenient contrivance, a device to articulate what is observed and experienced. He also points out the intuitive nature of our personal knowledge that always remain as a cover on top of our consciousness. Polanyi says:

> personal knowledge in science is not made but discovered, and as such it claims to establish contact with reality beyond the clues on which it relies. It commits us, passionately and far beyond our comprehension, to a vision of reality. . . . we live in it as a garment of our own skin. (p. 64)

The idea of passionate attachment and poetic articulation of science invites the combining of personal narrative and paradigms of science. Bruner (1985) argues that narrative science and paradigmatic science are two essential and irreplaceable modes of scientific endeavor. Bruner, therefore, points out a need to develop a science education that bridges narrative and paradigmatic science.

So far personal narratives or storied knowledge remain deeply separated from science. Because science is often considered an objective and rational way of seeking truth, the language of science education professes to be rational, logical, and true. Science and science education are therefore often remote from everyday life, since life is lived in stories that are built on passions, emotions, intuitions, beliefs and commitments rather than on rationality and logic. Besides, stories do not contest for truth. Narratives bring contexts, experiences, and personal values whereas paradigmatic science assumes a posture of logical and rational extension in abstraction and gives an image of universality. Merleau-Ponty says:

> Science manipulates things and gives up living in them. It makes its own limited models of things; operating upon these indices or variables to effect whatever transformations are permitted by their definition, it comes face to face with the real world only at rare intervals. (1964, p. 159)

The separation of life and science is even more striking in a country like Nepal where science education is only being developed and where modern science has no deep historical roots. A question arises: What would the paradigmatic scientific problems, explanations and criteria of evidence mean for a society that is unaffiliated with, or unaware of, the scientific paradigms and the scientific communities who set the paradigms?

This question is highly relevant in view of the Nepali school situations where science teachers with only a superficial introduction to the paradigm have to introduce it to their students. Perhaps, many science teachers themselves accept the paradigm because of the commitments that come affiliated with the role of "science teachers." For the students, what would be the difference of a new paradigm in place of an old one, containing myths and legends that offer explanations in their own ways.

However, it is desirable, as Martin and Brouwer (1992) point out, that school science be available for all kinds of student, teacher, and community contexts -- to help some students engage in serious activities, to provide interesting explanations to natural phenomena, and to provide immediately useful skills of interacting with the nature and environment. To achieve this there is a need to understand the contexts in light of the immediate concerns of school education. As van Manen(1991) points out, we have our duty to orient students to the subject matters that give school learning its pedagogical significance, to understand the students' situations in relation to teaching and learning, and devise a tact to help them learn in a meaningful way. For an educator, the important question at this point is: how should one address this issue?

Prior Knowledge and Storied Teaching

We now know that students not only bring their preconceptions about science or prior conceptions to the classroom (e.g., Novak, 1966; Posner et al, 1982; Clement, 1983; Flood, 1986; Cleminson, 1990; Lloyd, 1990). They also come with their own life stories and passions. We, as pedagogues, must recognize that it may not be in the interest of the students nor of the society to remove students' individual passions and replace them with those that might make them scientists. Martin and Brouwer (1992) point out that there is a need to let the diversity remain -- some students to appreciate science and enjoy its aesthetic aspect, others to look forward in engaging more deeply with science.

In either case, it is necessary to understand their narratives and to provide them alternatives that will facilitate the construction of their own narratives that are in harmony with science. We have to bring an understanding of the potentiality and drawbacks of science that has given us experiences of physical comfort through technologies as well as the horror of destruction through mega-war machines. There is a need to bring an understanding that it is important to understand life in the context of where it is being lived and developed and to think of science as a way to enrich our experience of living in a peaceful way and in harmony with nature. There is a potentiality in narrative approach to bring experiences of passion to science. However, there is a need to handle the narrative approach with a tact so that the students are not swept up by either a passion for science or detest of it before understanding what it really entails.

Narratives in Science: Research Questions

Starting from the argument that students believe what their personal stories inform them, it would be worthwhile to suggest that stories can be an effective mode of inviting personal engagement of the students into scientific concepts.

Martin and Miller (1988) describe the potentiality of a story to teach science in a more meaningful way when they relate the moons of Mars to the ancient myth of the warrior God his two sons Phobos and Deimos. They contend that stories and anecdotes help children to make associations and to see relationships among the facts they are studying.

Martin (1990) in his dissertation thesis relates an anecdote that he found was more effective than a demonstration or other explanations, to engage students in meaningful learning of circular motion. Starting from the anecdote, Martin devoted a whole chapter to discuss narrative elements in science education (p. 46 - 60). Martin writes:

> The story can at times communicate in few words that which a dense, technical analysis might require many lines to accomplish. There are some things that perhaps only a story can communicate especially when one enters the realm of ineffable knowledge or tacitly held understandings. (P. 46)

Brouwer and Singh (1983) in their review of the role of the history of science in science education have also pointed out the importance of the narratives in science education, particularly the personal stories of the scientists, in order to build confidence among the students to consider the tentative nature of science. This, they argue, would help students to personally engage in a more meaningful way in learning science.

Earlier I have related sociocultural beliefs hindering science education in India (Mahapatra, 1991) and Nigeria (Jegede and Okebukola, 1991). The study by Mahapatra in India showed that the sociocultural concepts and rituals about solar eclipses have generated certain alternative conceptions, which were quite resistant to extinction, among the students. For example, an appreciable percentage of the students believed that the devouring of the sun by 'Rahu' is the basic reason for an eclipse. And the students tended to defend the traditional belief using their alternative conception.

Mahapatra as well as Jegede and Okebukola suggest a need for bringing sociocultural beliefs for discussion into the classroom. By bringing the stories like that of the eclipse and Rahu into the science classes it may be possible to address the individual realities of the students thereby inviting them to engage in meaningful dialogues to see the world differently and to construct more relevant perspectives.

So far literature on narratives in science explicates the importance of narratives to understand how science is done, how scientists become attached to their science, or to catch pedagogical moments of scientists becoming teachers. What is in short supply is an understanding of narratives for science, for school children.

In the light of the above discussions, this study was conducted with a central question: **How effective is the narrative approach to science education in creating bridges between school science and the student's lived in contexts?** The following research questions are considered to address the central question in various dimensions of school education in Nepal:

1. **Is it be possible to construct science-related narratives that resonate with students' experiences, and help to bring out students' own narratives concerning science?**

2. **Are such narratives or student narratives develop a meaningful relationship between school science and the lived world of students and teachers? In other words can a narrative approach address the research question of bringing in social and environmental contexts into the science classroom?**

3. **Does the narrative approach also contribute towards the achievement of the content requirements of school science?**

These questions require an extended study to understand the possibility of narratives as a mode of teaching. There are many subjective aspects as well as structural aspects of school curriculum to study to understand the possibilities. These are the questions and issues addressed in this study by indwelling in a school situation to understand the situation and to look for possibilities.

Research Methodology

Contexts and Concept

Like Aristotelian differentiation between theoretical wisdom and practical wisdom, Fenstermacher (1986) argues that research is logic of knowledge production and teaching is logic of knowledge application. Research on teaching and learning bear on practices as the basic research

alters the truth or falsity of the beliefs underlying the practices. Behind this argument is an assumption that research can disrupt the lived realities to look for more authentic realities and guide the practitioners toward them. The problem underlying this is a tacit assumption that we as the 'researchers' are closer to the authentic realities concerning the practices than the practitioners themselves. This is a highly debatable issue.

Nevertheless, if we were to assume the role of practitioners we would also find problems with the current realities of teaching and learning: the issues of curriculum relevance, the issue of pedagogical consistency, the issue of transferability of knowledge, etc. Therefore whether from practitioner's perspectives or from the researcher's perspectives, we are bound to think and search for a better situation. However, we must be mindful that in research designing we may grasp an image of the current reality to construct what Merleau Ponty (1962) says a "second order reality," a reality removed from the direct first reality.

At this point what is important is a need to be mindful that practices do not stagnate in their own complexities of problems for a lack of research, and that researches do not indulge in abstract problems and solutions that cannot be translated into practice in a meaningful way. The best way to address this is to create an internal drive and dynamism in the practices to research on its own. In the practices like teaching and learning, the directions and the drives are constituted not only by the milieu of the practices but also by individual subjective aspects such as passion, intuitive insights, purpose and morality. How do we bring such diverse aspects together, interconnected? This question is central to this section on

methodology. The study focuses on reflective and interpretive practices of research in an action research setting.

Schon (1983) calls for self reflection on professional practices -- teaching as reflection in action. The quest of such reflective practices is to determine what is essential to understand, what is truly important or unique about an individual practice or system. This however brings forward the critical issues of what is the essence of school education, of learning, of teaching? These questions call for deeper reflection to probe further, to get meaning of lived experiences in teaching and learning.

The approach of phenomenology can bring insights into such lived experiences (van Manen, 1990 a). The phenomenological approach is a way to interpret lived experiences and to give meanings that make sense in the contexts of the experiences. Thus phenomenological interpretation helps to bring a holistic perspective about the experiences and the contexts. Conceptually, this is a suitable method for this study which is a search for a process to bridge students' and teachers' socially and culturally lived narratives -- their stories and experiential narratives grown from their living in the society -- with what they make out of the school science, stories and experiential narratives of science class. The interpretation required of the narratives is to search for holistic meanings -- culturally constructed meanings, meanings constructed in school classroom, and how they are lived. The intention behind this is to look for a way to de-center the authority of cultural fundamentalism that could create a narrow, rigid boundary on the world perspectives and to de-center the authority of school science that could shut off the door to social and cultural dimensions of life.

This should help let the students create new perspectives that are culturally as well as scientifically enriched.

Bringing the sociocultural and environmental contexts through teacher narratives and student narratives also bring experiential beliefs, interactions, and actions in temporal as well as spatial aspects. This requires that the interpretation of the experiences and understanding of the meanings be temporal as well as spatial. In other word there is also a need for hermeneutical approach in the interpretation of the lived experiences. Hermeneutic interpretation is a way to bring in temporal and spatial aspects in giving meanings. It is context oriented interpretation of lived experiences with opening for more interconnections (Smith, 1991). It is a spiraling process where meanings grow in an integrative way to encompass many inter connectives.

Situating the Study in the School Contexts

Given the meaning of school education in social context, the questions that stand basic yet often not adequately addressed are: What is the research is for? Who is doing the research and who does the research concern? (Filmer, et. al. 1972; Lincoln and Guba, 1985)

School has always been looked at as a place to transform students into able citizens with skills of living an emancipatory life (Baird 1986). However, in most developing countries like Nepal, socially disconnected science classes and a society, whose traditions are different from, in the contexts of modern science, are major dilemmas. Many critical studies (Freire 1973; Kohli, 1989; Carnoy and Samoff, 1990; Sirisri, 1986) reveal

the underlying sociopolitical structures as the fundamental problems behind such dilemmas.

Problematizing science education from a critical perspective in a developing country which has many sociocultural problems arising from its historical background shakes the very foundation of the school science education. Suddenly there appear many problems awaiting solutions such as that pointed out by Sirisri(1986):

> Curriculum developers must take into account not only the subject matter they wish to present but an interaction of all participants who interact with the curriculum. . . . The curriculum developers should try to encompass the entire social system and its determinants in an educational situation. . . . The current societal conditions, that are in some respect caused by ignorance and now the pervading presence of science and technology, should be addressed fully in a curriculum that discusses science as a social activity. (Pp. 212-214)

Given the socioeconomic and political structures which inherit the history of a non-democratic authoritarian social structure in most of the third world in social transition (Carnoy & Samoff, 1990), one may wonder whether such recommendations could be practicable at all. In retrospect, a question may arise: "Is a social revolution the only chance for solution?" Ellsworth (1989) critiqued some critical literature saying that such literature has grown too traditional, distracting the teachers and educators from the responsibilities towards the issues of immediate concerns. She says that such perceptions enhance inaction and create a sense of helplessness.

To live between the tensions of what is already there and what it ought to be, constant action is necessary. But we still need to understand the situation critically so that we are not acting against our own conscience. The

need is, therefore, for an approach that has critical understanding, and yet, viable for starting at the classroom, by the teachers and the students. The pace for such change has to be set by the school and community so that one does not leave the other too far behind. Thus the study was conducted while indwelling the school as a teacher as well as a researcher. It was an action research approach in the school community.

Action Research: Situating in the Contexts: An approach of action research provided a methodological basis for addressing the issues discussed. Action research is a collaborative endeavor that can address the issues in day-to-day practices in its ongoing process of reflection -- action -- observation taking a corrective stance to bring favorable changes in the situations that follow. Action research starts with small cycles of planning, acting, observing, and reflecting which help to redefine issues, ideas, and assumptions more clearly in a spiraling progression so that those involved can define more useful questions, at a different level, for themselves as their work progresses (Kemmis & McTaggart, 1988).

Action research is done for the good of the community (classroom) by the people (teachers and students) in their own pattern of day-to-day work (teaching and learning) observing and reflecting on their own actions and making corrective measures for the further actions (Carr and Kemmis, 1986). All participants are researchers in action research (Kemmis & McTaggart, 1988; McCutcheon & Jung, 1990; van Manen, 1990(b); Elliot, 1991). Writing about the PEEL project, a practical action research to improve teaching and learning of school science in Australia, White(1986) explains the benefits of an action research:

> The foregoing shortcomings of researcher-initiated experiments are overcome by action research in which the investigation is controlled by the teachers and to a lesser extent, the pupils of a school. Then the research is not something tacked on to the school's program but is an integral part of it. The participants own it, and they are not servant of an outsider. It can run for as long as the participants want, and its form is totally within their control. (P. 6)

An action research approach situates the research in a ground of contextual realities of the teachers and the students. It emphasizes the interactive nature of knowledge and a collaborative approach in teaching, learning, and doing research (Carson, 1990). It calls for empowerment of the participants in the research, but in doing so it also calls for credibility through actions and collaborations -- a call for self responsibility.

Action research approaches do not deny the importance of generative aspects of the research; but, they are not, at least in practical consciousness, allowed to dominate the school communities whether it is student community, or teacher community, or administrator community. It considers that the findings of a research are one among a number of possibilities for appraising and changing the practical arguments among all the participants.

Aoki (1989) points out three aspects as the basis of a complete curriculum inquiry: empirical-analytic, situational-interpretative and critical inquiry. These are based on three basic orientations of knowledge outlined by Habermas (1972): technical orientation, practical communication orientation and emancipatory orientation. The first concerns material well-being; the second concerns interaction and understanding of the others; while, the third concerns self consciousness and liberation from oppressive

situations. In a school context, these categorizations underpin the importance of

- understanding physically realistic aspects -- a need for efficient techniques and materials

- interaction with the existing school environment -- a need to act on the reality of the situation which includes group politics of teachers and students, and the community

- the role and purpose -- a need for consciousness and clarity of the purpose.

Shirley Grundy (1982) points out three types of action research -- technical action research, action research on praxis, and emancipatory action research -- as the three approaches to meet the requirements of material well being, better interactive adjustment, and liberation from oppressive situations, respectively. However, the practical experiences of some action research projects show that the three levels come in a sequential development starting at the technical level. For example, the PEEL project started to introduce various improved techniques such as questioning, concept mapping, Predict Observe Explain (POE) method (Mitchell, 1986). As the techniques were being introduced and improved, various readjustments took place in the relations between the teachers and students, teachers and consultants, and among each other. The interactions among the teachers and between the teachers and the students would have been minimal without the common intentions of introducing the new techniques. The

rigorous interactions on the other hand opened issues of who controlled whom, triggering reflections and readjustments in their relationship. In other words, the three categories of action research that Grundy has pointed out come about in a macro form of an action -- observation and correction -- reflection cycle in an ongoing spiral of action research.

Study Scheme

Though Kemmis & McTaggart (1988) and Eliot (1991) have elaborated on some logical steps for an action research project, the emphasis is on contextually specialized approach (Carr & Kemmis, 1986; Oja & Smulyan; 1989; Kosmidou & Usher, 1991). Following this emphasis, the research procedure for this research project was made flexible, though guided by the following considerations:

- Participant observation: I was a volunteer teacher in the schools where the research was conducted. Most information for the research was qualitative and was generated through interactive dialogues, students and teacher narratives, and personal observations.

- Flexible role: I was working as a researcher, a teacher, as well as a facilitator. I brought in examples, and took initiatives to discuss the contextual issues, outcomes, etc.

- The approach was a change-oriented ongoing spiral of critical and reflective planning, implementing, observing, and re-planning.

- Collaborative approach: The classroom activities and the studies on the activities were conducted collaboratively with the teachers. There were regular meetings with the participating teachers to discuss on the action planning and on the outcomes.

The research participants were oriented in this direction through introductory workshops at the beginning of the study and also in subsequent regular and informal meetings.

The Research was conducted in the following five steps:

1. Setting the groundwork: School access, class selection, forming collaboration, introducing the idea of narratives in science teaching

2. Generating teacher and student narratives and stories: teacher and student narratives and stories as a means to bring in sociocultural and environmental contexts

3. Getting insight into the narratives and stories: dialogue with the teachers and students to inquire into their stories and narratives.

4. A reflection on the research: an interpretive analysis of the observations, dialogues, and the narratives and stories.

5. An examination of the research approach: feasibility of the approach, implications of the approach.

1. Setting the ground work:

School Access: Much literature (e.g., Vulliamy, et. al., 1990; Dobbert, 1982) points out the problems of entry access into the school communities for research. The difficulty of bringing naturalness to the interactive relationships with the school community members is one crucial problem. Vulliamy explains how, even after getting close to a teacher, the interactions could be limited to peripheral activities such as helping in the games and outdoor projects. Most teachers did not like the idea of interference in their regular classroom activities. With these factors in view, the school selection for this study was made from among the ones where I had taught as a teacher, or from the ones where the teachers were known to me -- trainee teachers, a Science Education Development Centre (SEDEC) school, a school involved in the research conducted by Research Centre for Educational Innovation and Development (CERID). Obtaining a status of volunteer teacher for myself was also crucial for this study. Vishwoniketan High School in the city downtown and Gandhi Adarsha High School in the Kathmandu valley suburb were selected for this study (see appendix III). These two schools had indicated their interest in the study and their willingness to have me working as a volunteer teacher.

Grade Level Selection: Grades 7, and 8 were chosen for this study. These are the lower secondary levels where science is first introduced as a disciplined subject. Grade 9 and 10 were mostly occupied with the preparations for the national level centralized School Leaving Certificate examination. This examination virtually determines the access to the higher studies and jobs in Nepal.

Creating Interest: My first task in the school as a volunteer teacher was to create interest among the principal, science teachers, and the targeted students. This was done through informal talk and through discussions on sociocultural beliefs related to some scientific concepts. The enthusiasm of the teachers, students, and other school staff was encouraged. Attempts were made to form collaborative groups with the teachers, however, overexpectations and overenthusiasms were toned down, as I felt that the teachers were already overworked with several school-related as well as personal responsibilities. The experiences of the PEEL project (Baird, 1986; Mitchell, 1986) showed that overtures, at the beginning of a project may raise expectations that cannot be fulfilled, thus jeopardizing the whole program.

As a practical step to solve the problems of extra work required for the teachers to commit to new tasks required by the research, I negotiated some of their teaching work load. This, at least partly, accommodated the responsibility of the action research within their regular school work.

Initial contacts with the teachers were started to explain to them the study. Narratives related to the teaching units required for the selected grades were developed by myself as possible examples to bring in sociocultural and environmental contexts into the science classes.

2. Generating teacher and student narratives:

The main purpose of the teacher narratives was to generate narratives to help place science in sociocultural and environmental contexts and to provide students with practical examples of relating personal beliefs,

experiences, and stories, with science. The teacher narratives were encouraged with the following focuses:

- how lived experiences and beliefs can be interrelated with science
- that science does not have answers for all nor is it necessary to seek all answers from science
- that science can bring many good changes in our perceptions, beliefs and also in our way of life
- that some simple scientific knowledge can be of immediate use; for example, how to be environmentally conscious, how to be healthy, how to make drinking water safe for our health, how to use different alternative energy efficiently, etc.

In the schools, the narratives were discussed in formal and informal meetings with the teachers regarding how to use them and what to expect from the students when introducing the narratives. Such meetings helped to generate and reform some narratives and to develop ways of helping the students construct their own stories. It is important to note at this point that the narrative approach is only one way of bringing sociocultural contexts into the science class and that it is not necessary that all the topics should be taught effectively this way. The narrative approach was used where it better suited.

The students were encouraged to construct narratives related to the scientific concepts they learned. They were also encouraged to bring other

stories related to science from their home and community. The focus of the student narratives and stories were to explicate

- what sociocultural beliefs and scientific concepts related to one another

- what was most important for the students in the science class and in the society -- their sociocultural beliefs and the science concepts they need to learn

- how they handled science learning in the contexts of existing sociocultural beliefs

- how they handled science learning in the contexts of the environment they lived in

- what possibilities existed to bring classroom-initiated actions to better situate science in the social and environmental contexts

3. Getting insights into the narratives and the stories:

The intention of this phase was to clarify my understanding of the teacher and student stories; to get deeper meanings of their narratives to understand the contexts, beliefs and lived experiences embedded in the stories as perceived by the students and the teachers.

It was observed that many of the students found it difficult to express themselves in narratives. In such cases, my intention was to understand the barriers and see if there were alternative approaches, such as drawing and crafts, through which the students could (or wanted to) express their stories.

Interviews were conducted with the teachers and a sample of students to talk about their narratives. The student sample included those who wrote well, as well as those who did not.

4. A reflection on the research:

Basically, this was an expansion of the work in Step 3. The narratives, the dialogues, and the observations were interpreted for this purpose. Specifically, it was an interpretive analysis of the narratives, the dialogues, and the observations. The analysis was focused to set the contexts, to understand the praxis of the research approach, and to understand their implications.

Although the portrayal of a context will always be partial, spatially as well as temporally determined, it was necessary to plan a conscious action or to reflect on the situation. The context was focused on specific aspects: to better situate school science with in the lived realities of the students and teachers. The focus was in the areas of social and environmental context, school and classroom context, and curriculum context.

The research approach was guided by concerns like:

- The practices of teaching and learning of science could be improved by focusing on the natural and sociocultural environment of the students and the teachers.

- Language, sociocultural beliefs and stories would be important areas to investigate, to find possibilities of making science learning less problematic.

- Teacher and student narratives could be an effective approach to bring in sociocultural as well as personal contexts of the students and the teachers in the science class.

Certain structures were deliberately brought into the teacher meetings to guide the reflections into the various research aspects, e.g., integration of narratives, contradicting sociocultural beliefs and science concepts, situations that demanded immediate actions. Spradley (1980) described a method of theme searching and theme analysis in social aspects of school education. Although the method was not intensively followed, its approaches were referred to, to identify the action focus from the dialogues I had with the teachers and students. Similarly, Hammersley's (1990) classroom ethnography based on symbolic interaction was used as a reminder in observing and keeping the details of the classroom interactions and the interactions with the participating teachers.

5. A Reflection on the Research Approach:

Basically this was a reflective evaluation of the research approach in the schools. The reflection was based on the analysis of the potential implications of the approach:

- to change the perspectives of the students and the teachers towards science, sociocultural beliefs and the environment;
- to change the attitudes of the teachers and students towards the school science curriculum; and,
- to enhance better science learning and to appreciate sociocultural knowledge that helps better living materially as well as culturally.

Engagement in generating stories by the teachers and the students, involvement of students' parents or other family members in the generation of the student stories, generation of activities to improve science, society, and environment consciousness by the students and the teachers, and an improvement of the students' performance in science exams were considered indicators of success in the reflective evaluation. The interests shown by the administrators, parents or other family members, and other community people supplemented the reflections. The information regarding this was generated from dialogical interactions with the concerned people, students' exam records, and the observation journal.

Duration

The offices and the schools in Nepal are run according to the standard Nepali Calendar. There are three major vacation periods for the schools in the hills: Summer vacation in 'Jestha'/'Ashadh' (late June/early July), Dasain festival (the national festival) in 'Ashwina'/'Kartika' (late September/October), and long winter holidays in 'Pusha' and 'Magha' (late December to early February). The new school session starts from late February/March. The study was started after the summer vacation, starting from early July, and continued until the final exam sessions in early December. This provided a period of about six months, though interrupted.

Delimiting and Limiting considerations

Conceptual

There is a growing concern now about the validity of scientific knowledge challenging the traditional beliefs and world views. Is it ethical

to replace traditional knowledge with scientific knowledge; a traditional world view with a rational world view? The issue problematizes classroom approaches that bring traditional beliefs in conflict with the desired scientific beliefs.

Two things, however, overrides the issue in the present context of school education: First, the existence of traditional beliefs and world views does not cancel the scientific knowledge that has been developed or that will develop in the future. There is no harm in providing a different world view. Not to give the other option would mean confinement -- a kind of knowledge embargo. Second, science education is already there in the school in Nepal and also highly valued by the parents, teachers, students, and policy makers (CERID, 1989) in the country. The issue is not of nondesirability or nonacceptance of science by Nepali society, rather the issue is how to make science education effective and relevant. As a science teacher and as a member of the society working for science education, my obligation is to provide effective science learning for the students and to make it useful for their practical life.

There is a danger of extreme possibilities, though. The dangers of a derogative attitude of science teaching towards traditional beliefs, or the opposite when the two systems are brought in for a comparative analysis, especially in a conflict approach of science teaching. The need is to be cautious in such situations; to ensure respect for any of the belief systems; to understand the circumstantial nature of the beliefs and values.

Resolving the issues of leadership and collaboration among the teachers and between the teachers and researcher are not simple, especially

when we have to consider the school situation on the whole that includes the students. It is possible, during research interventions, that the participant teachers and students are sometimes rendered experimental subjects, or taken to act in some one's agenda (not necessarily the researcher's). For example, in the PEEL action research project, the participation of the students was not voluntary. A student participant, Dibley(1986) pointed out: "We also developed the term 'guinea pigs' to describe ourselves, or what we felt at that time ... Yet through all this we still continued to do it, we didn't really have a choice" (pp. 87-89).

Criticizing the hidden agendas in the participatory research programs in the Third World countries, Rahnema (1990) raises some important questions to bring up implicit drawbacks in such programs: Who initiated the research program? By whose knowledge is it being guided?

Most action researches are initiated by those who are committed to a purpose, by those who are in strategic positions, and who are willing to take the leaderships (e. g, Mitchell, 1986; Couture, 1988; Participant and Equity Program, 1987). For example, Mitchell (1986) was interested in improving the teaching and learning practices in Laverton High School by training the students in metacognition, and initiated the PEEL action research project in the school. His position as a teacher in Laverton High School as well as a lecturer in Monash University was crucial to the success of the PEEL project.

Given the fundamental considerations that action research is contextual and involves the participants as collaborating members, the action research represents a community in action, consequently, as in a community

work, the agenda, hierarchy, and interests cannot be rigidly individual in nature. Rather, they are negotiable and changeable. From this point of view, an action research could be considered a democratic endeavor like any other community oriented democratic endeavors.

Procedural

The main purpose of the study was to search for a possibility to bring in sociocultural and environmental contexts in enhancing the learning of science. The investigation was based on subjective interactions with the students and the teachers. The information was supplemented with critical reflections of the collaborating participants. It was assumed that such a combined approach will cover objective as well as subjective values of the research intervention.

Since the study approach focused on small teaching units, the narratives of the students were created in a fragmented form and spread over such small units and the students were exposed to the approaches' influences one small bit at a time. Besides, characteristic to the methodology of an action research, the later intervention in a class were always modified or different versions of the initial interventions. This limited a reliable absolute measure of an intervention. But, because the interventions were recorded and analyzed, and the overall change perceived in totality, such issues becomes insignificant. This was specially imperative from the other aspect of the study: to understand the dynamics that allow the teacher to bring the social, cultural and environmental concerns into the science class.

Since the study report did not pretend to represent all the school situations and to generate a generic process or approach, the issue of

generalizability and regeneration was transcended. It is imperative from the purpose of the research that it will represent a contextual case study of a school. The contexts and the outcomes may not be transferable, but their essence, along with the process of the action research, could be interpreted in different situations to generate similar kinds of research concerns.

The validity of the study is established through triangulation of observational data, student and teacher narratives, and the interviews with the teachers and the students. The teacher evaluation of the research approach also provide some clues to the validity of the study.

Significance of the Study

Racing against phantom-like endeavors to achieve development through science education, science education has many problems in countries like Nepal. On the one hand, science education in Nepal is still far from a respectable standard in terms of educational materials and other classroom facilities available for the teaching and learning of science. In addition, science education contents do not match the social and the environmental contexts in which the students and the teachers have to live.

On one extreme there are ongoing efforts to develop science along the footsteps of industrially and technologically advanced countries. On the other extreme, a question is being raised by those who wanted to maintain a social status quo: "Why science education for Nepal?" What seems lacking is an effort to solve the riddle of science knowledge vis-a-vis the social and environmental contexts. The present science education in Nepal lacks a context of the knowledge embedded in the sociocultural values and beliefs and a way to address the immediate environmental problems such as

deteriorating forests and water resources, poor sanitary conditions, fuel shortages, food shortages, landslides and degradation of land in the country.

From my lived experiences as a Nepali, I imagine our desperation in looking towards our school education for some respite. However, I continue to be dismayed by the fact that even simple improvements that could be brought into science classes, to aid in our well-being, remain uninitiated. For example, with a simple idea of keeping a well isolated from contamination, and with simple ideas of filtration many problems of unhealthy water supplies could be removed. In addition, with the use of wind and solar power many problems of fuel shortage could be alleviated. However, present science curricula do not address these possibilities.

This study is, hopefully, a significant step to understand the potential of science in our society. The study intends to understand the possibilities of opening up science classes to let in the sociocultural and environmental contexts through student and teacher narratives.

Carnoy and Samoff(1990) pointed out that most of the Third World countries rely on statistical data and objective evaluation of general national goals as the measures of developmental changes despite the contradictions visible to common sense that such development did not take place. Nevertheless, such statistical data and objective goals seem to have set a paradigm for most research as well as developmental programs in Nepal in the past: objective rationales, rigid objectives and methods, and statistical evaluation. The programs tended to find generic solutions at the national level as if all the schools have similar problems, aspirations, and set a

development pace, as if there were no cultural differences, environmental differences, and economical differences.

This study is critical of such situations. It emphasizes contextualization of the classroom activities to the current reality. It challenges the problem at the level at which it is hindering positive change as perceived by the affected people. Besides, the study is intended to place a sense of responsibility within the science classroom to make the society a better place by intending to remove the rigid boundaries between school science and social values. For the students and the teachers, it intended to bring fun and joy of addressing the issues of real life concerns in the classroom. Such an approach helps to de-construct the ritualized classroom tradition, and the myth of school education that it is a gateway for successful individuals to exit from, or remain away from the plight of hardship and disgrace of a typical Nepali lifestyle.

The study looks for possibilities by dwelling in the problem situations in order to bring about gradual changes that are possible without much stretching the school setting from its normal course. It looks for a change which originates from inside in contrast to the paradigm of externally imposed changes. It intends to search for an option of sustainable processes of change that will require minimum efforts of the development agencies.

Chapter III

NARRATIVE CONTEXTS

Narratives in science education -- what would be their role? How could they be used? Can they be a vehicle for scientific concepts? These are the questions often raised during interactions with the teachers, educators, and other interested people. Many of the participating teachers understood the narrative approach as a form of motivation to make students attentive in the class for the formal discourses in textbook science. Some suggested constructing or collecting only narratives which contained logical rational knowledge to teach science concepts to the students in an interesting way, such as the Aesop's story of a crow dropping pebbles into a half empty water jar to raise the water level. These aspects of science education are important too, but in this study narratives in science education are thought of in a wider meaning and use. Understanding the human experience is the central task of educational research, and that human experience can best communicated by "story telling" (Polakow, 1985; Connelley & Clandinin, 1990; Carter, 1993). Here, a narrative is considered not only for its potential in conveying knowledge and information, but also for its potential in conveying the wisdom that guides understanding, and use of knowledge and information, and in stimulating and opening up new areas of knowledge.

However, due to the way older narratives are considered by modern views of knowledge as myths that do not have concrete bases, narratives are not seen as important elements of teaching and learning in science. The first

section of this chapter presents the positive aspects of cultural or environmental narratives in the school situation of Nepal.

In the second section of this chapter, the processes of knowledge and beliefs in science and in social paradigms are discussed. There we will see how we are limited in our process of acquiring and internalizing the knowledge and information available for us. It is argued here that there is a need to be open to both forms of knowledge and to continually constitute a new body of knowledge integrating the positive aspects of all types of knowledge available. The third section of the chapter describes some of the cultural limitations, how festivals and other cultural ceremonies tend to give distracting alternatives if they are not somehow integrated into school-based education. This section also reflects on the importance of cultural narratives in the science classroom in order to make science learning interesting and useful to the students in Nepal. The fourth section of this chapter explains the different physical limitations that constrain school education in general and the introduction of new approaches to teaching in particular. We also argue how important it is to introduce narrative approach to mitigate the limiting physical constraints. Section five is an elaboration of how social aspirations work as a driving force to make the current situation continue.

The focus of all these discussions is to present the context in which the narrative approach to science education is being tried, so that the limitations and the possibilities of the narrative approach can be understood in a contextual and holistic way.

The Limitations and Positive Aspects of Myths

When considering the interaction of a society's myths and legends with modern science and technology, it is possible to consider the interaction from a number of perspectives. For example a typical dictionary definition of myth is

> A story presented as historical, dealing with the cosmological and supernatural traditions of people, their gods, culture, heroes, religious beliefs, etc. 2. A popular fable or folk tale. 3.A parable; allegory. See synonyms under fiction. (synonyms of fiction: allegory, fable, fabrication, falsehood, invention, narrative, novel, romance, story, tale. Antonyms: fact, history, reality, truth, verity.). (Webster's, 1990, p. 865)

> A traditional or legendary story, usually concerning some superhuman being or some alleged person or event, with or without a determinable basis of fact or a normal explanation. 2. An improved collective belief that is accepted uncritically, and is used to justify a social constructions such as slavery . . .. (The random house, 1966, p. 946)

From the dictionary definition, one is left with a number of rather negative impressions about myths. For example, the use of the words 'historical', and 'romance', leaves the impression that one is dealing with events that occurred long ago when people's knowledge, and methods of creating new knowledge were not as critical as they are presumed to be today. The use of words like 'fable', 'larger than fact', 'legend', etc. and the listing of the words 'truth' and 'reality' as antonyms also indicates that, with myths and legends, one is not dealing with reliable knowledge or wisdom. A modern person would be inclined to dismiss myths and turn to more reliable sources of knowledge. The dictionary definition also implies that the method whereby myths become accepted as true implies an uncritical acceptance,

not requiring empirical proof of any sort. The emphasis is often on an authority that somehow guarantees the truth of the myth or legend. Such uncritical acceptance of authority has presumably often led to the perpetuation of social injustices such as slavery, the suppression of minorities or of women.

The dictionary definition clearly reflects a positivist perspective of knowledge, in which statements (or stories) can be considered meaningful only if they are directly based on empirically verifiable statements. Such a positivist perspective of knowledge allows one to reject myths as simply meaningless stories, that fulfill no important function in the context of a modern rational existence. While not totally wrong, such definitions lack an appreciation of the positive cultural role that traditional stories or myths have often played in a society.

Myths have played and are still playing an important role in the structure and functioning of Nepalese society. The poetic and evocative aspects of myths have had profound influence on the beliefs of the people and have evoked strong social and moral commitments. The exotic culture and social arrangements that were generated with the power of mythic thinking argue against the shallowness of the dictionary type meanings.

Clearly, the definitions of 'myth' given in the dictionaries are not the only meanings of myth. In order to understand both the constructive and the restrictive role of myth in society, we need to find other terms to describe the meaning and value of myth in traditional societies, and explore ways in which traditional cultures and myths can accommodate the onslaught of

modern society, its knowledge, and its methods of validating such knowledge.

Garman and Holland (1989) provide a hermeneutic search for meaning to restore and establish a more wholistic meaning of myth. Rather than rejecting myths outright, and leaving a culture without roots and directions for the future, they suggest that a proper appreciation of myth involves both a demystifying and a demythologizing of the myths of a society. Here **demystifying** implies a stripping away of the nonessential elements of myth in order to recover (**demythologize**), if possible, part of the original meaning and purpose of the myth.

A hermeneutic vision of myth regards myths as playing an important role in the structuring of society and embodying in them the important truths or wisdom generated by that society. In other word, myths are a source of knowledge, and carry with them a moral authority and controlling power, that shape the behavior and interaction of people in that society, and also carry an evocative power, that shapes the poetry, drama and dreams of that society.

The hermeneutic meaning of myth unfolds both positive and negative attributes attached to the word. Positive in the sense that it provides a different way of seeing and interpreting reality; a peculiar way that carries with it its own store of wisdom that must be retrieved in a *mytho-poetic way* and that cannot be analyzed in a rational "scientific" way. This meaning making is a multi-layered process that may reveal glimpses of universal reality, or quest for truth, but may also contain elements of economic, agricultural, hygienic, or even technical wisdom. In many of the stories or

myths that are used as illustrations in the thesis it is possible to detect the ritualistic function of the story, as well as detecting a practical hygienic, or economic justification for the myth, provided the reader is open to searching for such a meaning.

For example, a Nepali mythology of Naga (a snake god) portrays Naga as a being that can change its form into a human or into a serpent as required. The Nagas are the lords of the nether world that has lots of wealth and resources, and the Nagas command the sources of water, cloud and rain. The mythology has the practical consequence of evoking deep respect towards the numerous serpents in the Kathmandu valley (Bajracharya, 1978). The people acquainted with the original culture of Nepal do not harm the snakes in the Kathmandu valley. Coincidentally, most of the snakes found in the valley are nonpoisonous and therefore harmless to the people, and very helpful to the farmers by controlling the pests. The myth as such does not make its ecological aspects explicit, but certainly represent some sort of knowledge or wisdom that enhanced respectful living with the numerous reptiles of the valley.

A similar mythology about frogs protects the frogs from being harmed. Nepalese mythology often considers frogs as beings which can change their form between frogs and demons. If let alone and respected, frogs protect the farm from other negative spirits and beings that devour the harvest. Once every year, the frogs are offered rice and lentils to commend them for their service. Again, there is little evidence of explicit rational ecological insight in the mythology, but it has the important function of

protecting the life of the frogs and enhancing the positive role frogs play in the functioning, and pest control, of a farm.

There are illusory components to much of the stories, and also limits to the "perfectly sound reasons" why the religious practice or story played a positive (hygienic or structural) role in Nepalese society. Many myths probably do play negative roles as indicated in the above dictionary definition. The negative aspect of myths may sometimes have followed from ulterior motives of the myths' originators, and may have consolidated their power through the evocative and controlling power of such myths. Alternatively, such myths may have arisen to provide a justification for social conditions considered reasonable and prudent in the distant past. Slavery, a caste system, the subordinate role of women, and numerous punitive and derogatory sociocultural rituals may have been codified into myth for such reasons. One might almost summarize, metaphorically, that a myth presents a vehicle which could be driven in a positive or negative direction depending on the motive and conscience of the power that drives it.

While the goal of the thesis is not to analyze the Nepalese myths per se, the continual interaction (or confrontation) between myth and science that occurs in the Nepalese science classrooms makes it necessary to posit a respectful appreciation and evaluation of these myths and the positive role they have played and might continue to play, in a developing nation. Rousseau, Garman and Holland (1989) point out that setting aside, ignoring, or deriding myth might well result in destroying the solid contact a society has with its roots, and leave its younger members without a sense of societal meaning and purpose.

However, there is also the danger of a continued uncritical acceptance of the myths since they may continue to support social practices and structures that have no longer a positive role in modern times. It is this understanding that necessitates, in this thesis, a flexible stance regarding the myths and cultural stories, often embedded in students' and teachers' personal stories (and perhaps also in the stories of science).

In summary, with regard to myths encountered in this study, I will assume the following:

i) Myths are a source of cultural knowledge and wisdom and therefore not to be disdainfully discarded

ii) Myths involve peculiar ways of seeing and interpreting reality and carry with them their own store of wisdom (which must be retrieved in a mytho-poetic way).

iii) This meaning may be multi-layered and may contain glimpses of a universal reality, truth, or quest, or may contain elements of economic, agricultural, hygienic, or even technical aspects of wisdom.

Iser (1974) captures the meaning of what I propose to do - to use the stories and the myths as a bridge between tradition and science. If one includes the perspective of the Nepalese children in the classroom, these myths or stories can become a means of bridging the world of science and the cultural world of the children and their parents.

All of us teachers and students who come to a science class bring our own understandings of the world which are not all "scientific" and many of which fall within the meaning of the word "myth". Whether or not one believes a myth, its presence among the general mass of people in Nepal constitutes a consensual view alternative to the rational scientific view. A sharp break between a cultural and a scientific understanding of reality may result in young people who reject their traditional culture, who reject modern scientific understanding, or who live in two sharply-divided intellectual worlds.

As discussed above, myths will be considered as a possible source of knowledge and yet the knowledge and the wisdom they represent are often misinterpreted because of their ritualistic packaging. By restoring the wisdom and knowledge of myth we restore our own image as complete human beings with many unexplored potentialities.

The interaction of the wisdom and knowledge of myth and the knowledge and methods of science will, therefore, not be treated in a confrontational way. The knowledge and method of science has produced undeniable contributions to bring humanity to its current prosperity. We know, however, that modern science and technology have brought with them a host of ecological and societal upheavals, and it is necessary to rely on other sources of knowledge and wisdom if a more traditional society is not to be thrown into total disarray and anarchy. It may be that a proper appreciation of the myths and stories of a culture may help it retain some of its stability and sense of purpose. In this research project, therefore, the classroom interaction of myth and science, of cultural story and science, is to

be taken as one of accommodation rather than confrontation, of mutual appreciation, as far as possible, rather than of mutual disdain.

A Question of Knowledge and Proof

Tat Savttur Varanyahm Bhargo Devashya Dhimahi Dhiyoyo Nah Praccodayat

(Like the morning lightens up bathing in the blessing rays of the Sun, Let the truth shine with the divine knowledge)

This Vedic verse, several millennium old, is now a part of religion though it embodies the same quest for truth as science seeks today. Novak (1971) says: "There are countless ways of living out the same doctrines . . . That is why it is better to imagine religion as the telling of story with one's own life" (p.45).

The difference between the two traditions lies more in the method for establishing truth, than in truth itself. The method of seeking truth and its verification in the Vedic era however remains unexplained for modern times and is therefore regarded as controversial. One controversy relates to the Vedic tradition of representing numerous conjectures in the form of sacred stories and verses to explain different phenomena of nature, and human psychological and social problems. By connecting those stories and hymns to the divinity tradition has bestowed in them a dominant authority that has for long remained unquestioned. Such a ritualistic augmentation of the authority of the initial poetic ideas have arrested the conjectures in them and insulated them from further change. They are not only protected from being challenged, but also often need not respond to challenges to their authority, or to other approaches to truth. The result is now they have become 'myths'

in the perception of a modern society: Myths in the sense that they are not amenable to critical appraisal and hence not susceptible to change.

This is a point of contrast with science, since critical appraisal has been one strong basis for the reliability of modern science. Although as Kuhn (1970) demonstrated, scientists have not necessarily always followed logical and rational ways, scientists may sometime become arrogant and overconfident in their 'knowledge', and scientific theories occasionally become so entrenched that they behave as dogma, there has, since the renaissance, been a tradition of critical appraisal that has eventually overcome such authoritarian attitudes. It is unquestioned that Popper's (1969) notion of putting conjectures to rigorous tests is considered one of the most important foundations of scientific appraisal. If a conjecture attracts the interest of an appropriate audience and also endures many rigorous tests to the satisfaction of the scientific peers, the conjecture reaches the stage of tentative acceptance. In a similar way a proposed scientific theory, if it survives a number of crucial tests, may achieve the status of a paradigm (Kuhn, 1970), in which it is accepted as (tentative) truth by the scientific community.

Another strong point of science is that a theory should continue to lead to progress in order to continue to survive. A scientific theory is most valuable if it is open-ended enough to lead to new knowledge, and in fact often inspires the new research that ultimately causes its own downfall. The main implication here is that scientific truth is tentative, not established for all times. Scientific theories or paradigms are models of reality, not reality itself. There is a whole process of struggle for a scientific theory to develop,

to mature and to shine, and eventually to pass away -- a process of interactive and creative dynamism. Through its evolving history, the scientific community has held to the idea of being open and tolerant to contesting ideas even if the practice has not always lived up to the ideal. Therefore the struggle of ideas in modern science is, in principle, more democratic and decent in the sense that it should not involve violent and irrational conflicts and that successful concepts and theories can be easily integrated into the mainstream.

The decent and democratic tradition of science however may not provide adequate ground to encompass all ideas and knowledge. People having different philosophical, cultural, and social orientations may have different attitudes towards science; science concepts may not be taken everywhere as valid knowledge and many religious and socio-cultural concepts are not, and perhaps should not be, made accessible to scientific criticism. Some segments of people in a different society are not yet open to new ideas, or are unwilling to open their minds to these new ideas. There is a sense of fear in being overwhelmed by the knowledge and products of knowledge that a new, and potentially conflicting, way of viewing reality has to offer. Hence many people in a developing society are attracted by a cultural isolation in which they can ignore all the new knowledge science has to offer. For another segment of society, the solution is the opposite - the members of this subgroup of society are so impressed by the bounties of western science and its accompanying culture that they grasp onto modern science wholeheartedly, and tend to ignore, or disparage, all the knowledge and wisdom their traditional culture has to offer.

This raises many practical pedagogical questions for a science teacher. How, for example, would people in an orthodox religious institution perceive the theory of evolution if they came across such knowledge without a sensitive treatment of their own cultural traditions of creation? How would a person in a remote village in Nepal, isolated from the main social stream, treat such a theory, if it were introduced to him or her more or less out of the blue? How would a junior high student perceive of the atomic particles, and the concept of charges without listening to the stories of how the concept of matter developed both in his and in other societies?

The problem of the confrontation of traditional knowledge and scientific knowledge arose in an intriguing little story one day in a junior high school staff room:

> August, 22. Vishwoniketan High School. As I returned to the staff room after teaching a grade 7 lesson about the animals and the plants around us in Vishwoniketan High School, I was wondering how familiar I and the other teachers were about these plants and animals. I asked my fellow teachers in the staff room to join me in naming the animals and plants around us. The list of animals quickly grew: Gobre Kira, Pan Ki, Sanglo, Kansutlo, Kukur, Muso, Chhuchundro, Sarpa, Biraalo, Bandar, Nyaurimuso,... As soon as someone mentioned snakes, Devi miss, an elementary math teacher, told us excitedly that she had come across a tiny cobra, the size of an earthworm, in the cauliflower she had been cutting for the morning meal.
>
> I asked in amazement: *A cobra in a cauliflower? I thought there were no cobras in Kathmandu!*
>
> Devi miss insisted that it had been a cobra:
>
> *It raised its head like a cobra, and it had a hood like a cobra. I was very scared so I threw whole of the cauliflower out through the window onto the garden outside the kitchen. But then I was worried; what would happen if some how it survived*

and got bigger? Will it live and grow bigger and be as ferocious and poisonous as a real cobra?

I could not believe her story. I remember how Gyani, who comes to help in our household work, had once been scared by a tiny snakelike creature. 'Snake! Snake!' she cried as she rushed out from the kitchen. Thinking that it might be a garden snake that had wandered into the house, I went to look:

Where did you see the snake?

She stayed at a distance while pointing at a hooded earthworm-like creature. It even had a faint yellow mark like that of a cobra. It raised its head like a snake and moved like a snake. Only careful observation revealed that the 'snake' had a damp and tender skin like that of a leech. I was not surprised at her excitement. I smiled and teased her:

How come a small worm can make you think it is a snake? It is simply a worm, a flat headed worm or maybe a leech .

She shrieked and ran away while I picked it up and threw it out into the garden. Nevertheless, I remained unable to convince her that it was not a snake. Why not? Did I not provide enough evidence to convince her? Or was there perhaps another kind of 'evidence' that carried more authority for her?

I have listened to stories of incredibly big pythons in the "Charkoshe Jhadi", an infamous strip of dense forest in the Terai foothills. These pythons were supposed to be so big and lazy that the hunting team to which the story teller belonged, started a fire on the body of a python, thinking that it was a huge dead log. People also tell stories of king cobras standing on the tip of their tails, scaring off the hunters on the elephants' backs; stories of king cobras spitting poison in the eyes of the hunters; of snakes 'photographing' the people who harm them and then coming back for revenge; of tigers seeking revenge for their lost cubs, and of elephants

turning mad at the people who encroach on their land, etc. Some of the stories are proven true scientifically, others are much exaggerated, and some are not found to be true at all.

It is not so much an issue of the truth or falsity of such stories, but the way people accept the truth of the stories. The authority of these story tellers, as has for long been the case in Nepalese culture, was usually such that the truth of their stories was seldom questioned. Instead the people would attentively listen and add their own interesting stories. These reflections made me wonder whether scientific evidence can simply take the place of the authority that the personal or traditional narratives possess in Nepalese culture.

It is not that the local stories provide a hermetically sealed wall but that they provide a general context that makes it very difficult for new ideas to be easily accepted. The following excerpt presents a typical classroom situation:

> August 8, 1993. A few days after we had finished a unit on 'Animals', and just before starting a unit on 'Electricity', Purna has a question:
>
> *Sir, crows don't die a natural death, do they?*
>
> I was taken aback by this question. But I remembered the traditional notion of crows not dying a natural death. To dig a little deeper into how students regarded this notion,

I asked: *Where did that question come from, Purna?*

Purna (a little timidly): *Sir, it is said that the crows have drank Amrit, the heavenly elixir that makes one who drinks it eternally pure and will never die a natural death. Crows die only when they meet accidents..*

Harka impatiently shouted at Purna: *Hey, this is science class! You should not be talking this 'Rudhibadi' (a baseless myth) in the class. Isn't that true, sir?* he added, looking at me.

Myself, curious at his comments, asked: *Don't you believe that the crows are pure and they don't die?*

Harka reflected on that for a moment: *I agree that the crows don't die a natural death, sir, I have heard about that, but there must be some scientific reasons for that.*

So Harka was at the stage in which he recognized that science had a different way of explaining things, but he had not yet begun to question the validity of his traditional knowledge. It did not surprise me that the class now began to buzz excitedly with local discussions regarding the validity of the notion that crows don't die a natural death and of other strange habits of crows: the fact that they gather in large crowds and make a lot of noise and then fly off on their own. Bimal was trying to convince his bench mates that the crows call periodic meetings to discuss their matters like we do. I understood what Bimal was saying: I had often noticed crows gathering, sometimes in big groups and some in small ones, at one spot or another. They would appear to make different sorts of noises at different times as if they were talking meaningfully.

Nevertheless, I thought I had to establish that all living beings must die, whether naturally or accidentally, and that crows die a natural death too. But apart from simply asserting it, what information could I bring to the students? I had never seen a crow dying a natural death nor had any of the students in the class. I asked the same question in the staff room, and with some friends, but nobody seemed to have seen a crow die a natural death. Many of them commented:

Well, there is a saying that crows don't die a natural death.

Anyway, how do we 'know' that a dying crow has had an accident or is dying from a natural cause? Did the students believe me when I told them that crows die natural deaths? What difference would it make whether they believed me or the traditional beliefs, or they whether they manufactured their own beliefs? How can a teacher motivate them to seek the scientific explanation without running the danger of having them reject all their own culture has to offer? This raises some of the more crucial questions related to science education: What are the most important reasons for teaching science in Nepal, and how can science be taught to Nepalese children in a meaningful way?

Festivals and Other Distractions

Frequent events of festivals and other cultural celebrations are important features of life in Nepal. Not only are there numerous religious and cultural festivals of national and regional scale, but also every Nepalese family has its own festive celebrations of different kinds. In a modern context of formal school education, as in other formal institutions, it is virtually impossible to adjust the individual affiliative desires and responsibilities to the festivals. For the teachers, their formal professional requirements, and for the students their school regulation requirements do not officially recognize the need or significance of such events. Thus in such occasions an ambiguous tension is being created between the formal school life and the social life of the teachers and the students. Here is one

such example that was observed in Gandhi Adarsha High School during the period of the present study there

> Shrawan 1 (July 16). Gandhi Adarsha High School. Today is Shrawan Sankranti (Sankranti is the first day of a Nepali month). Like in other numerous important festivals, today the school atmosphere reflected something special and different: Shrawan Sankranti represents the end of the hot and dry (Grishma) season and the start of the monsoon rains (Varsha). Soon the sun would be descending to the southern hemisphere and people would have their sowing completed.
>
> Today many would go to the temples to pray for good harvest and offer puza. There were also fewer students in class in the Gandhi Adarsha High School today. Many of them had vermilion and rice tika (spot on the centre of their forehead) The teachers were not even in a mood to teach new topics. Most teachers went to their classrooms just to review the previous lessons or to keep the students out of trouble. Guruba, the Nepali language teacher who is also a traditional pundit, started a conversation with me:
>
> *In Hindu tradition, besides numerous public ceremonies, almost every month, every day is a special day for one thing or another. We look for an auspicious day for doing anything important such as starting a journey, sowing, harvesting, starting a business, or starting a construction project, not to mention the marriage rituals which have so many important days before the actual ceremony. Each day is customized to the individual as his or her Nakcchetra and Rashi (Lunar constellations and Zodiac) dictate. Some of the observations of the stars and the Zodiac, and the planets that were identified, observed and utilized in our everyday life in our culture are scientifically significant too. But then we also have aspects of the rituals which are beyond science in a different realm of truth. However, there is no way to address them in science. Now you have brought us the interesting proposition of linking science with the culture and our everyday life, how are you going to address the matter?*

I reflected for a moment, not sure how to answer him. I tried to formulate my thoughts as I spoke:

I agree with much of what you said and the question you have raised is, in a way, my research question. The intention of my study is to seek understanding in this regard. I believe that our culture has rich tradition of generating, maintaining, and utilizing knowledge for the good of society, individual humanity and beyond that for the good of all living beings. But the drawback is that by binding them in different rituals they have now become obsolete in many aspects. For example, this day our tradition requires us to perform the offering of light and throw Kukur dahine, Kurilo and Amla, to protect ourselves from the disease of measles (Luto falne). In praying that the measles be banished from our home this day we may be psychologically insuring ourselves against the disease. But given the scientific reasoning for the disease and the modern cure that is available makes it difficult for me to still believe that the tradition has anything to do with immunity from the disease . . ..

Our conversation drew attention of other teachers.

Keshav sir asked: *You don't mean you will be teaching about what we do in Shrawan Sankranti in a science class do you?"*

Uttam sir added: *How will you ever be able to finish the course if you discuss such thing in the science class?"*

Akhil sir (perhaps, being a science teacher) tried to support me: *Those things will be used to motivate the students to think about our values that are useful, but the main emphasis will still be science teaching.*

Akhil's mention of motivation reminded me of the issue of the day: fewer students were interested this day to come to the school and among those who came fewer wanted to stay in the school. The pull of home and places of importance that day was evidently very strong. There were interesting things going on in the community; food, worship, prayer, crowd,

laughter, and all kinds of activities that come with a crowd in a ceremonial mood. However, from the perspective of objectivity, the classes should run to fulfill the school requirements. One cannot give in to such light merry making that has nothing to do with development; for the students to become serious citizens, doctor, lawyers, engineers, enterprising businessmen . . .. As if those cultural happenings were not for the students and the teachers, as if for the teachers and the students nothing was going on in the world outside. It seemed that the school demanded a school type obedience beyond the contexts where the teachers and the students have to live. The society was still flowing in a traditional way enticing the students to come and plunge in its charming realm.

Will it be possible for the students to engage in learning activities while outside in the home and community ceremonial atmosphere prevails? I recalled moments of my own experiences as a student:

> The day was Rath Yatra (Chariot festival) of Janamahadyo (Matshendra Nath as the Hindus call it). The chariot hoisted across the city by hundreds of devotees and pleasure seekers draws thousands of people to a festive mood: Music of different kinds, aroma of incense, flowers, bright and nice dresses, windows full of anticipating faces, streets full of onlookers, children running and playing: the atmosphere is so difficult to put in words. Being a junior member of the attendant community of the temple, I would be allowed to be on the chariot. Yes we had a feast to commemorate the beginning and we would have a similar feast at the end to commemorate the successful completion. But, of course, that day I was in the classroom, (grade 8), fourth period; how could I be there? After a tiffin break between 1:00 to 1:30, we would have science class in the fifth period.
>
> I wanted to go and see what's happening in the ceremonial place in the tiffin hour. I would need to run there and come back

running. I thought: "Maybe I will be a bit late, but what the heck, I will sneak in quietly; I know the teacher would not roll call until the end of the class and there is always somebody who sneaks in late. At the most I will get a twitching of ears or a slap on the hand with the long ruler that the teacher always carried to the class." I wished this Nepali teacher would leave us few minutes earlier.

At the first stroke of the bell I was already out of the class back door and to the stairs running down. I would not have dared to do that in English class or in the science class or math class, nor in the geography class. Those teachers were very strict and they remembered you the next day to give a good punishment. I sneaked home and hid the books in the chhidi (basementlike floor) by the side of the stairs and sneaked to where the chariot was.

People were still preparing for the chariot festival, groups of traditional ritual drummers and the guruju's ceremonial army arrived with loud music and blast of the refill riffles. After a fit of respectful banging, they stopped and dispersed, waiting for the auspicious hour to begin. I climbed the chariot to where the god was enthroned, there my elder kinsmen welcomed: *Oh, you arrived?* As if they were waiting for me. Another fellow comes up and see me. Astonished, he asked:

How come you are here, it is not even school closing hour? How about if your father or brother see you?

What time it is?

2:30.

I slumped down feeling guilty. But it was already too late to go back to school, and I did not want to go back anyway. I went down to get lost in the crowd around the chariot.

Several years later it was our turn (two men from my family) to take part with several others the responsibility of carrying the Khat (a small ceremonial structure carried like a palanquin) from the temple to the chariot

and be in the ceremony from the beginning to the end; on the chariot when it is hoisted, change the turns on the chariot to provide 24 hours duty, be available in the temple premise for so many other ceremonial duties. I was now a university student, and my examinations were spread over an expanse of weeks. But there was nobody to substitute for me at the festival!

My elder brother, who had the duty of a headmaster, and I had a hard time trying to convince the community to allow us to leave the premise of the temple to resume our other duties when we would be free. And of course, I wanted to appear at the exam in ordinary dress instead of the ceremonial dress, to wear cotton shoes since it is impossible to reach the university campus barefoot, and to ride a bus or bike. It was a difficult proposition for the community. How can an on duty poojari be engaged in other earthly vocations? How can an on duty poojari of Janamahadyo wear a cap and shoes too? Though clean shaven for the temple duty, I was prepared to go without the cap but not the shoes. The other problem: the kitchen manner -- we all needed to prepare our own strictly vegetarian food together and eat together in the temple kitchen. We could have food only one time in a day, about the lunch time. Fortunately, my exam times were little earlier than lunch time.

Our demands were not granted for the fear of setting a precedent. Both my brother and I had no choice; I must appear at the exam for my future opportunity to claim a decent space in the new world that was increasingly subsuming the traditional world. My brother had to be in the school so that his duty was delivered honorably, that is so valuable for us economically and socially (in the new world). And yet, we value our

tradition because the tradition has a philosophy, commitment, and ceremony to feel good about our social heritage. Also we have a community to belong to because of the tradition. Nevertheless, I did go to sit in my exams and my brother did go to the school every morning to supervise and manage its daily work, as a result we had to encounter frowning eyes and sarcastic remarks. I was not happy having to appear at the exams while engaged in the ceremony; there just was no chance for me to refresh and prepare for the exams.

Once every four year or so, our family faces a similar dilemma regarding this custom. There are several other social events and duties, some bigger and some smaller, that required more or less prolonged engagement and commitments. I can imagine similar dilemmas in the other families of my community also.

My dilemma may be one of the extreme cases of having to actively live prolonged cultural and ritual customs. But every Nepali family has more than one occasion each year where the cultural ritual and custom requires us to be in a space which contradicts our requirements to be in the modern institutes; school or workplace: Shraddha, Dewali, Vratta, . . . The choice is between what were socially good; of having a cultural heritage that makes us feel good and what makes us think good in preparation for the approaching future, the hope of claiming a space in the modern world.

Perhaps the desire to reform our rituals, to make them more meaningful and enriching were embedded in our national aspiration of developing school education. But the unsaid and unformulated development was to turn the school into a 'one way launch pad' for the children to jump

from our traditional society into a different world. To keep a continuous rapport between the school and society was very difficult. What seemed to be lacking is a means to make the two world interact, to form the school as a bridge to make the two world exchange and change.

The dilemma of the schools in Nepal today still continues: the children are still required to make the large jumps. Some are successful to get a hold on the new space assuring them of a modern job, some are forced to abandon the jump for the fear of the loss of identity and loss of the foothold in their community, some are dropped in the uncertainty, having left the traditional foothold, but unable to complete the jump to the ultimate end. These students, as well as some teachers are "trapped" in between two cultures, not being able to feel at home in either one.

Two more instances of pre-festival time in school:

> September 20, Gandhi Adarsha High School. The festival of Mohani Nakha is only a week ahead. The school is already in the mood of the national festival. There were fewer students in the school today compared to yesterday, and they liked to remain outside the classroom. The staff room was full of talk about the preparations for the festival, the market prices of clothes and about Khasi, the recent economic hardship, and the compulsion of celebrating the festival and bearing its heavy cost.
>
> A group of teenagers came to the staff room with what looked like a pad of lottery slips. Yes indeed, it was a lottery pad. The students approached every staff member in the room to buy a ticket for the sake of the library project in the village. Each ticket cost twenty rupees, but most of the teachers did not buy one, because the prizes were somewhat unconventional - Khasi meat (castrated goat), 20 kg, 10 kg and 5 kg. The teenagers approached me also to buy a ticket.

I appreciated their efforts to establish a library in the village especially since the community did not have strong literary tradition, but like the other teachers, I really didn't want to win a prize. So I gave them twenty rupees as a donation instead. The teenagers were surprised by the offer, but they accepted it. The other teachers were also more interested in giving a donation rather than participating in the lottery.

The children, however, were at a loss. They whined:

We can't do that! If we collect donations, the villagers are not interested, and if we make it a lottery, the teachers don't approve!

I felt sorry for the boys. I wanted to suggest to them that they should compromise - collect donations at the school and hold a lottery in the village, but they had left.

I asked the teachers who the boys were. They smiled. Krisna Bahadur Sir said:

Well they were problem kids in school. They flunked the SLC examinations and are now on their own. They enjoy doing these sorts of things but not study. An undisciplined bunch!

The event and the dialogue left me wondering whether it is good to be so disciplined that the students could do nothing but obey the teachers, or whether it might not be better to disobey the teachers and strike out on their own wild imaginations. It left me searching for the rest of the day for a third alternative - how to strike a balance between the two.

November 11, at the Gandhi Adarsha High School; today is the last school day before *Swanti Nakha* (in the Kathmandu valley language) or *Tihar* (in the national language), the festival of light, and fruits; of cows, crows, and dogs and Brothers' day, which starts next week.

I was in the staff room together with a number of other teachers. As usual, on the last day before the festival, the teachers were in

a jolly mood, laughing, joking and engaging in chhedkhani (witticisms). There did not seem any restriction on the talks and gestures; discussions were jumping from the school ground to the international arena, and from small disputes to ideological arguments. Students were coming in and going out of the room, or peeking in the window, inquisitive about what made the teachers so noisy and happy.

Suddenly a group of students scampered into the staff room holding bunches of flowers, mostly marigolds. The students tore the flowers into small pieces and threw them on the teachers. The teachers laughed and threw up their hands to protect themselves, but they seemed pleased with the students' gesture.

The headmaster came into the staff room, armed with a long stick and urged the teachers to go upstairs, check the rooms, and send the students home:

Kids are destroying the furniture in the classrooms, send them home!

Some of the teachers went upstairs with sticks in hand, shouting:

Badamas haru, go home now, no class today, vacation is on, go home and prepare for the exam!

Another group of students entered the staff room, their hands full of marigold pieces, but ready to run away. Keshab Sir was caught in the hail of flowers and amid a chorus of laughter, caught a student by one arm, and smeared the student's head and hair with the marigolds. For a moment the teachers appeared to be winning the flower battle, but then wave after wave of students came into the room covering the scolding teachers with thousands of flowers.

Uttam Sir could tolerate it no longer: *Hey, hey! Why are you doing this, it is too much now, no more or else!*

One student retorted: *You should not say this today. Today is the last day before the festival!*

> One last group of student came to the room. This time they brought single, untorn flowers, perhaps to hand them to the teachers.

Keshav Sir, now rising: *Again eh!*

> The students threw the flowers into the room and scattered. A few more flowers came in through the window.

Kamala Miss summed it up: *See, the Tihar Pooja is on. We worship every thing: cows, crows, dogs, brooms and Nanglos (big circular bamboo food trays). So the students did the same with us. Sometimes it's good for us teachers to be treated like gods.*

Yes indeed, we have lots of instances to celebrate different events; the Dasainn, the Indrajatra, the Seto Matsendra Nath Rath Yatra, the Rato Matsendra Nath Rath Yatra, the Ram Navami, the Gai Jatra, ... Each time the school community is thrown into a tension of being in the ceremony and the objective requirement of the school in which such Jatras virtually do not exist.

Several questions arise: Is it good to reduce or ignore such festivals and ceremonies so the school can engage the students in the school activities? If not, how do we situate the school in regards to such social happenings?

The Physical Limitations

As discussed at length in Chapter I, Nepalese schools have to live with extreme limitations of physical facilities and economic hardship. Many hopes of better classroom approaches have to be given up because of such limitations. And perhaps it has become almost ironical even to think about bettering classroom instructions from that sense: Teachers have more than

enough frustrations and suppressed wishes to better the classroom situation. A conversation with fellow teachers illustrates some of the limitations:

> August 22. Regular science teacher meeting at Vishwoniketan High School in the staff room. The question for today's meeting was: How can we better the science class given the present circumstances of the school and classrooms.

Shanti Miss quickly responded: *Of course, science teaching with practical activities to support the concepts that we teach should be more effective and interesting, but how could we do that when we don't have enough time to even finish the course content.*

Uttara Miss, Kamala Miss and Gauri Miss supplemented in inseparable voices: *There are more than 70 students in the class. We don't have enough material even if we wanted to conduct activity -based science class. Besides, we have to keep the classroom under control so that it won't disturb other classes.*

Toya Raj Sir added: *What counts more in our school system is exam results and strict classroom discipline for the students. If we do not finish our course we will be held responsible by the school administration, who in turn have to face the guardians. We can have small demonstrations as motivation but activities for the students is a rather difficult thing. In the class what is important is to ensure that the students do good in the examination so that their good futures are ensured.*

There was a moment of deep silence after the comments, perhaps in support of the statement or in the realization of the limitations of the school education as lived. I too remained silent, for I thought there was no simple alternative. This silence also disclosed unspoken problems of school education in Nepal. Spoken problems included the widely published issues of crowded classes, lack of furniture, lack of appropriate space for making proper classrooms, and lack of educational materials (CERID, 1989).

Unspoken problems are those that cannot be put in simple words such as the attitudes of the school administration, parents, teachers, and students. These are taken-for-granted realities that seemed to drive strong undercurrent for school activities and priorities. The following classroom experience/observations further illustrates the complex nature of the physical limitations of school education in Nepal.

How about breaking the class into smaller groups and having groups of students working on different types of activities? I have brought up this suggestion several times in the teacher meetings. Finally I tried it myself in the class.

> September 30. Gandhi Adarsha High School. My intention for the grade 7 science class in Gandhi Adarsha High School this day was to give hands-on experiences on lenses and microscopes. Since there were too many students (75) in the class to engage them all at once with the few microscopes (3) the school had, I divided the class into a smaller groups of 9 or 10. My plan was to engage one group in the hands-on activities in the science room with the microscope while the others would be engaged in the lesson activities in the classroom.
>
> I started with one group in the science room showing them how to set a microscope for observation. After a while I realized that most of the students from the classroom had already gathered on the window shelves of the science room. Perhaps, their curiosity brought them up, I thought. I tried to convince them to go back to the class room and wait until their turn. Apparently it was not an easy choice for the students: I herded the students back to the classroom and I stayed in the class room to make them continue with their work of drawing pictures of plants and animals.
>
> But, the other students from the science lab were already outside the classroom looking in the class curiously. The students from the science room came down, unable to remain

> engaged with the microscopes on their own. That day I spent the class time running up and down between the science room and the classroom to keep the two groups of the students engaged in two different activities. It was exhausting. But it seemed that the students needed a teacher to keep them engaged in the activities whether in science room or in the class. This made me feel a need to train the students to work on their own and to create their own interesting learning activities.

The experience of trying the idea in the class made me realize that all new ideas are bound to encounter these limitations. Nevertheless, there was, among the teachers intense enthusiasm in doing something of concern -- something that would be interesting to engage in. We talked about this in our formal and informal teacher meetings. In Vishwoniketan we decided to keep up the enthusiasm by organizing a science fair for the students to engage in different science activities of their own interest with what the school could afford. This, we thought, would not adversely affect the traditional requirements of the classroom activities that seemed to address the student anxiety of the exam more directly.

The issues of examinations and expectations of school education in paper certificates are not new (e.g., CERID, 1989; UNESCO 1980), and yet they seemed to form major problem that has been arresting the perspectives of classroom teaching. They challenge the very enthusiasm for a change in the traditional classroom teaching. The following classroom observation/dialogue reflect the subtle nature of the issue:

> October 31. The Dasain vacation (Hindu Festival; National festival like Christmas) is just over. The final examination, annual school examination is only few weeks ahead. I had already completed the required course work, topic wise as described in the textbook. I was thinking about engaging the

grade eight students in an imaginative activity of drawing pictures and in story making about the ecological relationship between animals and nature. On the blackboard I wrote the terms: cows, men, meadow, birds .... and I asked them to think of as many animals and plants as they could that match with the meadow and to draw pictures, or write a story or whatever to show their relationships.

Vivek who was in the middle of the boys' section commented, hiding his face: *Sir, when are we going to study the course, the exam is very near?*

I was taken aback by the comment, I tried to hide my panic and explain how the course work was completed.

Myself: *You have read all the topics in the book yourselves; we have engaged in discussions related to the topics; we have had some interesting activities that included some demonstrations; and you have been given class tests with the related questions. Are you not happy with what you did in the class?*

Arjun jumped into the conversation: *But, Sir, the questions in the examination will be from the book. You have not taught us the questions and how to answer them. If we don't know how to answer and what to answer we will fail the examination.*

Myself: *You have done good in the class tests, I don't think you will fail the examination if you did those class tests genuinely and you prepared well for the final examination. Now, be imaginative, be creative, let us enjoy study and activity. Someone come out and write the picture of a meadow and the animals and plants on it.*

I waited with the chalk in hand in a gesture of offering. Some students were still making fuss about not teaching from the texts, not picking up questions and answering them. Purna's mood was however totally changed.

Purna: *May I come sir?*

Myself: *Sure, why not?*

Lots of noise from the crowd as the students tried to draw pictures and interpret them. But then I challenged them to hand in their efforts, and I said I am going to read to the class those which are interesting. Sound of rustle and bustle as the students drew their copies, pushed the ones sitting next to make space and started writing. Amidst the complaints of *"Sir, he pushed me; he took my pencil; he spoiled my drawing; . . .."* Niran and Suran, two brothers, raised the pictures to show me -- *Here, Sir.*

Myself: *Wauh! Pretty good! You even managed to color! Anybody dare make such picture?*

Meena: *Sir, their father is a professional painter, they paint signboards, number plates for the "motor" and "motor cycle"*

Myself: *Do you help your dad?*

Niran answers: *Yes Sir*, and blushes, while looking at the floor.

What a lovely work! You don't have to be ashamed of what profession your dad is in. I would be proud to own that type of shop and work if I could. Such skill would make you a nice and fine young man more useful in the society than the average. Now keep up your work. Can I make a request to make a bigger picture in a nice paper so that it could be hung in the science room?

Niran: *Sure*. (Now more confident and smiling)

Now there are many hands raised to show the pictures. I started to pick them up one by one and admire, or make a comment, and so on. While I was doing this, I was still thinking about Niran and Suran. They are not good in the examination. One of them had remained in the same class because of failure in the examination last year. Before we could talk about the relationship of the pictures to the scientific concepts I wanted to teach, it started to rain. Swirling wind brought a gush of rain into the classroom through the windows that are bare except for the iron grill. As the seats by the window side got wet, the class became a chaos. I called off the class for the day, and stood at the door staring and waiting for the rain to subside. I couldn't go out now that I had to pass through the open area to reach the

> staff room. Anyway what's the point in hurrying? The staff room is no different from the classroom.

One positive aspect that this event shows is that when a science teacher's expectations are a bit broader, many more students have the opportunity. It is also necessary to stress here that if expectations of science education also included the works of boys like Niran and Suran, then more children could be successful. In fact, it was found later after the examinations that Niran and Suran did succeed in the examinations despite some teachers' expectations on the contrary.

The student concern for the exam was not exaggerated. They have to live up the anxiety of passing the grade level exam, and there are lots of students who fail to go onto the next upper level grade. Gauri and Uttara had pointed out that the students too are tied up by the requirements of school curriculum; they have to finish home work in all subjects, they have to prepare for the examinations, some of them might have private tuition, etc.

The whole educational situation seemed to be in a rather tenuous balance between school physical limitations, the limitations of school curriculum practice, the students' personal limitations, and also teachers' personal limitations. The teacher' personal limitations stem from the socioeconomic circumstances that require them to engage in several responsibilities. When I was a high school teacher, I had two shifts of teaching, one part time in the early morning and one in the day, and I had some students in the evening for private tuition; Yeshodham Sir was teaching in two different schools, one in morning shift and the another at the

day shift, and in the evening he coached students in private tuition; Toya Raj Sir had a hardware shop to look after, before and after the school hour. Gauri Miss teaches in two colleges in the morning hour before coming to the school. She was taking care of the son and daughter of her brother who had passed away and she has remained unmarried for that. Kamala Miss had her whole family to look after at home and yet she manages to do some private tuition. Looking after home and family is a heavy job in Nepal where virtually every thing has to be managed at the source level, such as getting water for drinking which would require one hour of physically intensive work. Getting fuel is another troublesome job, and managing food requires day to day haggling in the market because of the lack of refrigeration. Bringing children (if very young) to the school, laundry and attending to social rituals and customs etc., all make for hectic responsibilities.

Except for me at that time because I, as a researcher, had explicit interest in thinking about possibilities and potentialities, none of us had extra time when one could be at peace in contemplating innovative activities for the school classes. And I wonder, even if I were to be able to influence the teachers to think about such activities at home or at school how long would that be sustained? Nevertheless, nobody declared unwillingness to consider changing science teaching, for as science teachers all of us were ideally required to do such things all the time. We all agreed that the problems have to be lived with, but we must also have hope in change for the better.

The Traditional Expectations of Science Teaching: Another Limitation

Hami pani padhna paye ramro luga launtheun
Hata ma file bhiri desha ghumi hindtheun
Ke garnu karmale halo jotne bhako
Gariba bhai janmanule saroh dukkha pako

(Had we education, we would have better clothes and the easy life of an officer. Fate has us born to be a tiller, to toil in rain and in shine)

It follows from the preceding sections that there is a need to change the way science education is traditionally done, and that there are possibilities of better scenarios too. One approach to better scenario is through adequate improvisations of material and activities. This has been attempted in numerous science education improvement projects and also by some economically capable schools on their own, but with little success. It has now become much more evident that there is a need to change the traditional perception of science education -- a more fundamental change that requires more of understandings and commitments than material: a change to formally address the student's and teacher's lived world in science education. At this point there may be a problem in this statement since the traditional popular expectations of science education may demand something different from such perception of objectives for science education. The popular demand of education as discussed in chapter I has been to get away from the life being lived. In a desire to rush away from the hardship, there seemed a blurring of vision that made us unable to see the reality in a broader horizon -- a need to improve the situation rather than to get away

from it. That was what I thought of about when I read the opening phrase above as that I came across in a rural Nepalese village about a decade ago.

In summer 1984, a friend and I were on a field study regarding environmental awareness in Sankhuwasabha district, in Eastern Nepal. Two people, about mid twenties, were singing a lahari bhakha (a long village tune) while tilling a small plot of terraced hill by the side of the trail we were walking. I was overwhelmed by the melodious sound of the song, and I smiled at the singing people without a grasp of the meanings of the words. Being a native born of the land, my friend recognized the intention of the song. He found it little uneasy, so he walked on without stopping. I followed him confused. Later he explained:

> *You know, their song was meant for us: because we have education, we could get this job of going around collecting data, doing research, etc. For them our work does not seem to demand any effort.*

Yes it was hard to swallow the words; that they had to live that physically hard life compared to ours. It may or may not be purely circumstantial to our birth differences but they certainly played a role, I thought. Perhaps not. What has education to do to achieve physical comfort? One thing is however certain, that without education one cannot be an 'officer' that they thought we were. The song haunted me throughout my field trip. It still does whenever the scene comes to my memory. Did I have my education to get away from the difficulty of physical toiling? Perhaps not, for it was extremely unlikely that I would be in the vocation of farming, for I was not born a farmer, nor did I own land. Nevertheless I remember some elders, whenever they caught me (when I was very young)

trying to escape my homework, teasing me "now you are looking forward to carry khamu (wicker shoulder basket) to sell vegetables". This made me recall the case of Niran and Suran the two boys at grade seven who were excellent in drawing, painting and model-making and yet they were not very successful students. It was ironic that they had to feel ashamed, when singled out, that their parents owned a painting shop (p. 86-87). Certainly, it reflected a derogatory social value whereby those who have to work with their hands to live should feel humiliation and frustration.

Perhaps this was an expectation from our modern education in Nepal that those who successfully complete it to a certain degree in the university get the post of 'officer' (a white collar job). Given this context, what would be the expectations from an individual subject? What do we expect from the learning of science in the schools? I wondered what I would be doing without this credence of modern education.

There was no comprehensive reason why I learned science, nor any of the other subjects in the school from my point of view as a student. But I was interested in science for what it was renowned at that time: discoveries, technology, and unfolding of mysterious knowledge. I did hope to learn more about what I was interested in, like making an electric torch, a magnet, an electric bell, playing with an old clock that did not work, with eyeglasses, making slide projectors, etc. And also because I wanted to pursue science for my higher education, as everybody interested in my education wanted me to.

To become a scientist working in a lab would be fun too: the white aprons, and the fancy equipment of science labs in the university colleges

were attractions. The university science students appeared to be in a class of their own proudly carrying the protruding practical records etc.

To my experience, the expectation from science education was a complex combination of several things. Nevertheless, as a science student, as a science teacher and as a scientist (?) there were several expectations or at least inquisitions directed towards me at various instances at work places and at home by friends and family. For example,

-- *Can you make an atomic bomb?*

-- *When all the planets are going to line up, will there really be a disaster as some astrologers have predicted? Tell me about the rocket, how it works?*

-- *We heard there was this mysterious thing like a ghost; here comes the scientist, now tell us what do you think about this?*

-- *Now these Thimeli people (farmer traders from the Eastern part of Kathmandu Valley) can calculate so fast and so accurately, can you calculate faster and better now?*

It seems that there was an image of a person with a science background, vaguely bounded by what they are expected to know, what they might be interested in doing, and what they can be. This image of the scientifically trained person could involve:

- Science for vocation: Becoming a doctor, engineer, researcher

- Science for material welfare: Technology and skill

- Science for unfolding the mysterious natural world: Scientific discoveries

- Science for attitudinal development: Passion for rational pursuit, producing scientists

These are to be found reflected in the talks with the students, parents and the science teachers. I found similar views in conversations with the students and some parents during an exhibition conducted in Vishwoniketan High School in the course of the field study. Most junior high students wanted to do experiments, interesting experiments that would make people wonder, attract their curiosity and bring something spectacular and unpredictable:

> October 28. After we teachers did not get the anticipated responses to our request for students to participate in the science exhibition in Vishwoniketan High School with their own proposals, I wanted to know why. I brought up this matter in grade 8 A.

Prakash said: *Sir, our exam is pretty close and we don't want to spend our time in preparing for science fair.*

Mukunda asked: *What are we going to exhibit, sir?*

Myself: *Well, that is up to you.; whatever you want to do.*

Mukunda: *But sir, we don't have interesting ideas.*

Rajendra: *Give us activity book , sir, and we might be able to find some nice experiments.*

I agreed but I also reminded them that they could do so many things from their textbooks such as the preparation of gases, the making of

magnets, experiments with lenses, experiments with liquid and air pressure etc. I gave a few examples of how they could be done. This sparked some interest in the students.

Next day there were lots of proposals, some more interesting than others in terms of the visible effects. I and the other science teachers tried to convince the students to retain their proposals for making the items for the exhibition, but many students who had simple proposals (for example thermometers, barometer readings, experimentation with densities and the buoyancy of water etc.) were dropped. They thought the experiments would not be interesting enough to catch the attention of the visitors. Those who brought proposals for making batteries using potatoes, models of volcano with bursting chemicals, preparation of hydrogen with demonstration of burning it with popping sound, etc., were proudly engaged in their showing and explaining their work in the exhibition. The cutout models, collection and display of the various plants did not draw crowds as much as those which made sound and moved.

> November, 10. The science exhibition in Vishwoniketan High School was just closed. Mr. Bikram Singh came a little late to see the exhibition. He works in a travel agency office and could not come earlier. But he was aware that his son would be unhappy if he did not make it to the exhibition. His son Rajendra wanted him to come and see the item he displayed in the exhibition. After spending some time admiring his son's work, Bikram asked us whether one of us would be available to coach his son in private tuition.

Bikram quickly added: I *am not very rich, but I am prepared to spend whatever I can to let Rajendra study science.*

Myself: *Were you a science student?*

Bikram: *No but I wanted to. I did not have enough score in SLC exam to pursue science.*

Myself: *But why did you want to study science?*

Bikram: *Well I guess you know; if you get higher marks, you can get one of those scholarships to study to be a doctor or engineer. Even if you cannot get one of those chances, science studies at the university will teach you a way to study and you can do better in other subjects, if you chose later to study other subjects.*

An earlier study in Nepal (CERID, 1989) showed that doctor, engineer, and scientist are the most valued vocations that the parents wished their children could attain. These are modernist aspirations or at least those which tended to move the students away from the life their parents had been living. However, the study also indicated that except for wishing their children to succeed in achieving a better vocation, most parents did not have any idea about what their children were learning in science, or what they would like their children to learn from school science.

It would be very difficult to imagine what would have been the expectation of education in the absence of modern school education, for the tradition too would not have remained static. Nevertheless, there was a traditional structure of learning: to become enlightened with the divine scripture; to study Ayurveda (Vedic tradition of medicine) to become a vaidya. In addition, painting and drawing schools were affiliated with monastic schools or passed on clandestinely in apprenticeship. Most other skills were passed on through apprenticeship. In the study of grammar, Ayurveda, Veda and other holy scriptures, there was vague differentiation of the classes like Purba Madhyama, Madhyama, Uttar Madhyama, Shastri,

and Acharya. But these were of little concern for most people who had a caste-oriented family vocation to master and to pursue for their livelihood.

Given these past traditional contexts, modern education, particularly science education has given a new hope and aspirations to look to. However, it calls for a deeper reflection whether the image that science education has raised up in the parents and students in general are anywhere near the image intended by those who design and deliver it.

The expectation of the designer of science curriculum are put in the form of goals, aims and objectives. The UNESCO Hand book for Science Teaching (1980) elaborates on the importance of the well-thought goal, aims and objectives in science education and how a thoughtful science teacher could realize hollowness of teaching science without such aims and objectives. The hand-book reflects the desire of science educators in Nepal as well. For in Nepal, there is an emphasis on the goals, aims and objectives in curriculum development and in teacher training. The high school science curriculum objectives in Nepal state:

After the completion of secondary level education the students will be able to

- describe fundamental scientific facts and concepts
- describe the structure and properties of matter
- describe the basic concepts related to earth science
- explain the concepts related to earth science
- describe the structure and life processes of living things

- describe the interrelationship between living things and the environment

- develop basic scientific skills and make use of them

- prove scientific principles and laws and make conclusions of experiments

- develop a scientific attitude

(CERID 1988)

One problem with such aims and objectives lies in its disparity with the popular aspirations of securing a better vocation for the children. For most parents, as discussed above, what goes on in the schools is of little concern -- what is most important is how the students leave schooling. This gives rise to the culture of the certificate: what grades the students obtain, whether they are eligible to pursue the studies that would take them to the most valued vocation. This puts the teachers as the deliverers of the aims and objectives in a dilemma:

> teachers are often worried when they are teaching children whose parents are anxious for paper certificates and little else. Such parents have either little education or a formal one and they may feel there is something wrong with a school which does not drill facts into children. To such parent, there is a sense of security when the child comes home with a pile of books and lecture notes to be learnt. (UNESCO, 1980, p. 180)

This is reflected in the true efforts of the teachers who tried to incorporate their skill and imaginations to address the demands created by the contexts. The class conducting style of Shanti Miss better illustrates this.

August 3. I went to observe Shanti Miss teaching science at grade 7 B. Shanti Miss was pleasant, often smiling, but quite firm. She had strict rules regarding classroom discipline but used a lot of student presentations in conducting her classes. The lesson of the day was about vertebrate and invertebrate animals.

Sita, one of the grade 7 girls presented an example of an invertebrate animal: *Miss, a cockroach is an invertebrate animal; it has a head, thorax, abdomen, and segmented legs. The body is covered with an outer shell and it has wings. It belongs to Arthropod group.*

Rasmila, another student, gave a different example: *Annelida is an invertebrate group. The earthworm is an example of this group. It has a segmented body, a sucker mouth at one end and an anus at the other end.*

Maya gave a third example: *Platyhelminthes is an invertebrate group; they don't have hands and legs, some of the animals in this group live in fresh water, others live in the digestive system of the animals. Namle Kira is one example that lives in animal bodies.*

Shanti Miss asked: *Does anyone want the presenters to repeat or explain something?*

The class was silent. They appeared to have no questions. Now it was the presenters' turn to direct some questions to a group of students, who had been picked for this purpose. Amir was allowed to select the student to be questioned.

Amir called out: *Roll No. 12.*

Binita (Roll No. 12) stood up to answer a question.

Maya, one of the presenters asked: *What is a Platyhelminthes? Give me two examples of Platyhelminthes.*

Binita answered: *Platyhelminthes is an invertebrate, it is made of plate-like segments. Namle Kiraa and planeria are two examples of this group of animal.*

Shanti Miss: *Are you satisfied Maya?*

Maya nods her head in affirmation.

Amir calls another number: *Roll number 19.*

Another student stood up and the question sequence continued. The rest of the students in the class were very attentive during the exchanges, but one group of boys in the last bench were complaining that the questions were not hard enough. Nevertheless, the session was over shortly and Shanti Miss asked the students to draw pictures of the invertebrates individually.

Some students had already made the pictures at home. They showed the pictures to Shanti Miss. Others continued to draw at their desks. Since those who had finished the pictures at home had nothing to do, Shanti Miss asked them to read the text or draw a picture of another invertebrate. Throughout the lesson, the class was extraordinarily quiet, obedient and engaged.

I asked myself whether the children were so quiet and involved because of the teaching style, or because of the personality of Shanti Miss. Or could it be that they were so quiet for this period because there was an outsider observer in the class?

What is evident in this event is the crispness of Shanti Miss's class management style, the "objectivity" in addressing the course content and hence to the examination, and resourcefulness in bringing activities such as drawings, passage writing etc. What was however missing was the lived contexts, the local names of the animals being studied instead of the Latin names, the real life examples of the animals and their situation in the children's environment. Our living environment is very much infested by

tape worms, round worms, hook worms, etc. They have local names too. But because they were not talked about in the class, it would be difficult for the students to relate the classroom learning to their normal conversations at home and in society.

The UNESCO hand book for science teaching acknowledges that the practice of stating aims and objectives is fairly new but is now characteristic of most of the major curricula developed since the middle sixties. A question arises, can we reform the aims and objectives in order to make science education a bridge between what is desired of science education and what the students and the teachers actually live. Also, the discussion above reminds us of another question: how do we make aims and objectives impart a practical effect on what goes on in school? The latter question arises in light of the physical limitations of the schools discussed earlier in this chapter.

Chapter IV

STORY TELLING IN SOCIETY AND IN SCHOOL

The Importance of Story Telling in Nepalese Culture

Story telling (Bakhan/Katha in Nepali) is one of the highlights of the traditional social activities in Nepal. Every aspect of daily life, as well as social and religious rituals, are linked in one way or another with the traditional stories of Nepalese society. The paintings, carvings, and other artwork in public places such as temples, on the temple walls, and in private houses, often portray the themes and characters of the stories. In many of our rituals, cultural dances, and ceremonies are conducted along the themes of these stories. Thus the many traditional stories reflect and display the many different dimensions of social life in Nepal.

Broadly, the stories told in Nepal are of four categories. Of these, religious storytelling is revered as one of the highest levels, reflecting the deepest level of social activity in Nepal. There are many different forms of religious story. Some, such as the Dharma Katha, are religious and holy stories interwoven with lots of poetry or rhythmic chants. These stories are very voluminous with hundreds of different episodes or are collections of hundreds of different stories. Religious story telling is usually accompanied by several ceremonial rituals and may take weeks, months, or sometimes even a whole season to complete. Such story telling is usually public and pious in nature and, although special invitations are often sent, the celebrations are open to the public. These stories are usually told by

professional story tellers who belong to a special caste of traditional pundit families.

One of the strong social beliefs in Nepal is that the knowledge compiled by our ancestors is very vast and diverse. In principle, the traditional stories are a vast repository of knowledge and wisdom, including knowledge of modern scientific concepts and inventions. There are stories that involve ways of sending pictures over large distances in the Mahbharata stories, stories of flying machines in the Ramayana and Mahabharata stories, and a variety of war machines such as long range missiles, and explosive devices in the Ramayana and Mahabharata stories. These stories, together with numerous other Sutras (treaties) and other writings, are still considered an unfathomable sea of knowledge where one can find explanations for all happenings in the past, present and future.

Other stories, such as the Pancha Tantra and Aeshop Niti stories, used to be part of the school curriculum for language instruction. These were mainly stories of morality, of social relationships, of ways of living and interacting with animals, and the rest of the environment. These stories also told of the consequences of breaking such relationships, and ways of amending broken relationship, in the family, the community, or in the state.

Other groups of stories, such as the Dantya Katha, are mostly about the bravery of princes and princesses or of shrewd and heroic people who rose to power in ancient Nepal. Thus they are mainly historical in nature, and reflect the themes of heroism, strength, wisdom or shrewdness, and luck, as well as the themes of frustration, poverty, dissension, and fatalism. In

most of these stories heroism, comedy, truth, bravery, and wit win over false, demonic, and dark forces.

Another set of stories, the Lok Katha, are mostly about social woes, virtues, fate, faith and hard work. They also present stories of wit and local wisdom overcoming such things as greed, hatred, and evil or demonic powers. Many of the stories contain elements of skill and technology to be learned, such as engraving symbolic messages by means of intricate weaving, stories involving the extraction of oil from seeds, ways of preserving of food stuff, etc. Some of the religious and heroic stories also contain elements of important skills for living and are therefore also included, in modified form, in the Lok Kathha.

Many of the folk stories and folk lore are presented in the form of metaphors -- metaphors of events and happenings that are encountered in the immediate environment. There is, therefore, a long tradition of understanding difficult techniques, moral lessons, or social relationships, in terms of analogies or metaphors. Another important element of many of the stories involves the tradition of making animals speak in conjunction with humans. This results in a respect for animals, and the conviction that animals are fellow creatures that have their own inherent right to exist, as well as humans have. This orientation is probably based on the religious conviction that animals are creatures like us, but trapped in different bodies because of what may have happened in a previous existence.

A possible negative effect of such stories is that they tend to bring forth a more or less fatalistic orientation towards life -- giving up the zeal to

struggle, for we are subject to the inexorable power of a blind fate, and to be resigned to live in the confinement of the world created by the stories.

Although some of the heroic stories, the Dantya Kathha, are to be found in the school curriculum, both the Dantya Kathha and Lok Kathha social or cultural stories, were the domains of grandmothers, and of the children gathering in the Chowks (the public squares) and public corners. In the not very distant past when there were fewer electric lights and school was practically nonexistent, it was common for the kids to gather in the Chowks or temple squares to play, talk and tell stories. In the winter time when it was very cold, the children would huddle around a small charcoal heater with grandmother, and sometimes other adults, to play games, to solve riddles and to tell stories.

The following story illustrates some of the important elements of a typical story that would enthrall the children, and at the same time, teach them something important about living safely in an often dangerous environment.

A Story from Jatak:

> A retinue of Bhikchhus were on the way through a jungle. The retinue had been walking for several days. On one unlucky day, the Bhikchhus could not find food and water for several hours. It was a really hot sunny day, they were getting very tired and thirsty. There was nowhere a place where they could find food and water. After several hours of struggling along, they finally came across a deep pond. Rejoicing, the Bhikchhus ran to the pond for hearty drink of water. But the Shramenera, the head of the Bhikchhu stopped them from drinking water.
>
> "Look at the pond, there is no living thing visible in the pond! There must be something, or else the pond should be full of life!" the Head Bhikchhu said.

> The head Bhikchhu then dipped a twig in the water, and the twig immediately melted leaving a black stain in the water. "No, we cannot drink this water," the Bhikchhu leader said. And the Bhikchhus proceeded further for several more hours.
>
> Fortunately, they came to another pond. Again the leader asked the retinue to remain calm, be observant and reflect before venturing for the drink. He indicated how unusually calm the environment was: there seemed to be small fishes in the pond but they weren't sure yet that the water was safe.
>
> Thereupon the leader threw a large stone into the pond. Upon this, a big alligator and many other smaller alligators came to the surface and threatened the Bhikchhus. The alligators said: "Well, you all are going to die anyway since there is no other water resource, so one of you should come forward to be eaten and we will let the others drink."
>
> The head Bhikchhu, with his meditative power, came to realize that the alligators were not really interested in making a deal, and would probably eat them all, if they came close enough to drink. Thereupon the Bhikchhu told the alligators that they were not prepared to make any deal with them and that they were going to drink the water anyway. He told his group to bring some bamboo sticks, to hollow them out and to suck the water through the sticks without having to go near the pond and hence to the alligators. The Bhikchhus then made their hollowed bamboo sticks and quenched their thirst in the very sight of the gaping and hungry alligators, and then continued their journey.

Besides the intrinsic interest of the story to the listening children, there is a moral teaching - be careful and reflect before you act rashly, but also a little technical teaching, sucking the water out from the pond, which contains the basis from which a lot of science teaching about air pressure could flow.

An example from the Dhammapadath:

Once a lady who was grieving with the death of her only child approached the Buddha and lamented:

O Buddha, you are called lord by everyone and are worshipped for your wisdom and for the power that overcomes all obstacles. I am thrown into the deepest grief with the death of my only child, please restore him back to life.

Upon this, Buddha tried to convince her of the process of life and death and that there should not be such thing as reviving from death. As the lady insisted and threatened to self immolate if the child's life was not restored, the Buddha agreed to try use his wisdom to revive the child but on one condition - that the lady would fetch a bowl of rice from a house that had never ever been touched by death.

After several days of visiting many houses and asking the inhabitants whether or not somebody had ever died in that house, the lady began to realize the inevitability of death and to accept the death of her child.

To learn about the natural rhythms of life and death, to learn to accept, and live within the boundaries of what life has to offer, are a few of the important lessons young people have to learn. Such teaching could be carried out in a didactic fashion, but the effect of the narrative approach anchors the important teaching in a memorable context which is easily remembered for a lifetime.

From the Aeshop Niti stories, which may well be of Greek origin, and entered into the Nepal tradition many hundreds of years ago, there are similar stories, which are of narrative interest but also teach a little 'science' lesson:

A thirsty crow once found a jar of water. But the water level was too low for its beak to reach it. Desperate with thirst and

> determined to drink the water it contemplated ways to get it. After a while, the crow was moving back and forth with small pebbles on its beak dropping into the jar. Soon the water level rose and the crow was able to quench its thirst.

In a modern grade eight science class, the relevance of this story to buoyancy, or to the displacement of water, would be immediate. The historical lesson intended here is more probably related to the encouragement of inventiveness in everyday practical affairs. Thinking and reflection are seen as often showing a way to resolve what at first may seem to be an insoluble problem.

Importance of Stories in Education

There are by now several authors who support the importance of the use of stories or narrative for education. Bruner (1985), for example, maintains that there are two distinct ways of knowing that have relevance to science teaching. The paradigmatic mode of knowing focuses on the empirical-rationalist basis of science, and emphasizes primarily the concepts and the skills required for doing science. The narrative mode, by contrast, is more divergent and strives towards the creation of a world of shared meaning between the teacher/scientist and the student. In the narrative mode teacher and student can draw on shared stories or experiences that help to create a common world for the teacher and student. Stories help teachers to aim at the imagination and experience of the students and help them to view such experiences in a new way.

Carter (1993) indicates that the stories we live are, in some sense, not "private inventions" at all. Most of our stories are built up from our

experiences and from the inventory of stories supplied by our culture. Hence such stories are bound to resonate with the experiences of others who share our cultural backgrounds, including our students.

Karuna Kar Baidya (1985), a folk tale specialist in Nepal writes: The folk tales can form a basis for the curiosity of rational minds of scientists, and possibly students, to further look into the things that the story portrays. For example, the mythical concept of earthquakes being caused by the transfer of the earth from one shoulder of the Naga to the other could inspire the scientists, or students, to look into the real, physical cause.

Certainly some of the modern projects of science are inspired by the mythical stories. I would like to recall a report (Michael McRae, 1987) on human-powered aircraft -- the Daedalus -- to be launched from a beach in Crete to cross to the Greek mainland. The project was inspired by the epic flight of the mythical Greek craftsman Daedalus, who soared with wings of wax and feathers. "For 3500 years everyone thought it was a nice story; now we have ability to make it come true" the writer quotes a builder of the plane. (McRae, p. 80)

As mentioned above, story telling is an integral part of Nepalese social life. The stories and the tradition of story telling provides the content and the teaching methodology of the informal education system. The content of the story focuses on the language, morality, wit, commitment and actions. This education is open, public and without walls and is therefore not visible in the sense that a modern school is visible in the form of grades, dress, school buildings, etc. There is no passing or failure in this open school but the understanding of the story shapes each child in the child's own

individual ways. Despite its informal nature, the cultural stories contribute in subtle and strong ways towards how a student perceives the world.

If we value the social traditions and the traditional ways of transmitting Nepalese culture, it may well be beneficial to devise ways of utilizing both the content, and the mode of presentation of the traditional learning in order to weave a knowledge that represents a more meaningful integration of traditional and modern knowledge and practice, so that school education could become more colorful, and open up more viable possibilities of contributing to the new, emerging Nepalese culture.

Stories in the Classroom: Stories by Researcher

One most important questions of this study was: Can the researcher and the participating teachers construct narratives for science class, that resonate with students' experiences? In this section I intend to elaborate on my efforts as the researcher to construct such narratives. My efforts to construct narratives for the science classes in Nepal started while preparing for the field study -- recalling on my experiences as a student as well as a science teacher and selecting those which were more closely related to the course contents. But in the course of bringing those stories to the classroom it soon became evident that such narratives, planned and constructed without actually being in touch with the class, did not resonate with the students' experiences. So I had to modify or abandon such narratives and construct new ones while engaged with the classes. The following is a discussion of these experiences.

In one of my initial attempts to entice my students to bring some of their own stories to class, I started them off with a story I remembered from my own grade eight science class:

> *I was a grade 8 student. In one of our science classes, our science teacher told us the story of Archimedes' discovery: While in a bath-tub Archimedes discovered that when a body is immersed in water the body experiences an upthrust of water which is equal to the weight of the displaced water. This principle enabled him to predict the gold content of the crown that the king had him evaluate. This was the last day of the seven days granted by the king to do this job, and had he not done that correctly, he might have lost his head. Overjoyed, Archimedes jumped out onto the street, without realizing that he was stark naked, shouting 'Eureka, Eureka!' Which meant 'I found it, I found it!'*
>
> We burst into laughter.

Of course, my own grade eight students were laughing and giggling also as they imagined this ancient Greek scientist running naked through the streets simply because he had discovered what must have appeared to the students to be a rather obscure scientific principle. I continued to reminisce:

> *When I was in grade eight, I knew that the volume of milk, water, kerosene, or oil could be measured using measuring pots. The volume of a rectangular box could be measured by measuring its length, breadth, and height, but how could someone measure displaced water while in a bath tub? I wondered what the bath tub looked like, for the tubs I had seen used for bathing babies did not seem good to measure such displacements. I had never seen grown-ups taking a bath in a tub. And, as a Nepalese youngster, I wondered, why would Archimedes be bathing in the tub completely naked? I thought maybe he had underwear on, and to be only in underwear was still called naked.*

Later, our teacher explained how water could be made to spill over and collected for measurement. I was overwhelmed with that idea. One day I was tempted to experiment with the used water in the laundry basin at home, since fresh water was hard to get, and secretly tried to figure out for myself the volume of such things as a glass bottle, stones, a wooden bread roller, and so on. When my sister saw what I was doing, she scolded me while throwing the water in the drain. I tried to explain that I was not playing but she was not convinced. Nevertheless, I did not miss a chance to do my experiment again, whether I was washing vegetables, or clothes, or while carrying fresh water in a carrying tub. I often got a scolding from my mom, my sister, or elder brothers whenever they caught me playing with water. To be honest, I often lost the purpose of experiment and started to play with make-believe experiments since I did not have the proper material to do real experiments. But I think I did get a better idea of the principle of displacement and buoyancy.

I used this story in one of the lessons for the measurement of volume by displacement and Archimedes' Principle. After the story I asked the students to write their own stories, or anecdotes which related to their experiences of displacement in liquids and of lifting forces in water.

There was silence. The students had obvious difficulties in conceiving stories in response to my instruction. I sensed, as is usual in a junior high class, that they were waiting for some more instructions. I had brought some plastic measuring cylinders, some stones, threads, and a spring balance. I brought the material forward and asked if anyone would like to play with them. The class still seemed confused. I asked Bikash to bring some water from the tap on the collection tank for drinking water just outside the class. Happily he brought some water. He was happy to do the experiment of displacement as long as I took the leading role.

Purna, one of the boys in the class raised his hand: *We have done that experiment before sir.*

Myself: *So, tell me what you did in the experiment , and what you learned from it?*

There was silence in the class.

Myself: *Does anybody want us to do this experiment?*

Again there was silence.

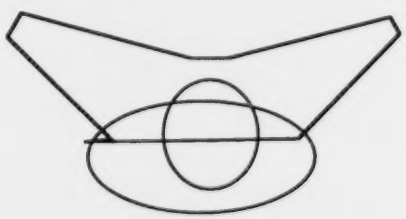
I thought there was no need to repeat the experiment just for demonstration purposes, since it had already been done, so I constructed some problems on the board to calculate volumes by displacements. Some of the students quickly came up with the answers and I demonstrated the problem and the solution with the cylinder afterwards. I sensed that the students were still pleased to see the experiment done. As I prepared to put the instrument aside, the students on the nearest bench cleared their desks so that I might place the apparatus on their desks. While I gave the students some more problems to solve, some of the students came up to play with the equipment, while others worked on the problems. There were also some who were no longer interested in Archimedes' Principle and started to do their other home work of the next period -- English writing.

This was one of the initial stories that I constructed to be used as an example to generate student and teacher stories in my field study. As I reflected on the story, I found some difficulty: the story did not have direct link to the content of the science we studied in the class nor did it give a moral. I was not sure that the story would be useful in the actual classroom. What did we use the story for?

There was a possibility to recall my own experiences as a student or as a teacher and as a researcher. There was also a possibility to construct stories focused to the curricular needs. Since the school contexts for my personal stories seemed rather vague, looking at the textbooks and the curriculum to think about the stories seemed to be a natural approach.

The second story I related to my class was designed to reflect the importance of careful observation in science, and that sometimes observation is more than just seeing.

> *I have four brothers, and one of them is an artist. He loves drawing scenery, people and classical pictures from our cultural stories. I love to watch him draw things. It is amazing how things stand out as real from nothing. Sometimes I try to draw something myself, faces for example, but they don't really look very lifelike. They come out rather obscure, not to scale, and funny. I have to explain to everybody what I drew, because it's not always obvious from my picture. One day I was watching my brother draw something, it ended up looking something like this (and I drew it on the blackboard):*



> *I had no idea what he was drawing. But as he encouraged me, slowly, the picture turned out to be that of a man meditating, sitting cross-legged, viewed from above. I had never before thought how people would look from above The picture of a man that I would draw would be a flat outline in a face-to-face perspective. That was a lesson for me to realize that how things look different when seen from different perspective.*

I used this second story in one of my lessons to help the students realize their perception of things and their actual observations depended on the way they looked at things.

This story was linked to the unit "Observation and Drawing of Objects in our Neighborhood". The students had listened to the story silently and appeared very interested. In response, I was expecting them to tell the class some of their own observations or experiences. However, they remained silent as if waiting for me to continue the lesson. Again the lesson was turning more into a lecture by me rather than a sharing of experiences. Hastily, I drew the moral out of the story and then engaged them in a drawing activity:

> *It is often very important in science to visualize things in picture for we need to make sense of what is there in a picture and sometimes even express our ideas in pictures so that others can see what we see or think. Why don't you try to visualize something of your own interest such as a fly, a flower, a person, or even a stone, and carefully draw picture of what you observe.*

The students responded very well to this instruction. The class was filled with the clitter clatter of geometry boxes and the hustle-bustle of their pencil sharpening, and their going in and out from the narrow benches. Some of the drawings were very good, many students took the activity of drawing to their home. I thought the story did make some impression on the students to be open and careful in their observation and in making drawings of the things they observed. However, the next day some students complained that they liked the activity but it that it had been too time consuming and that they did not have enough time to work on the other

subjects. The story did work as motivation for them to observe and draw what was around them. However, it did not stimulate them to bring their own narratives.

Of course, the students did not have any experience in bringing their narratives to a science class. Perhaps the way the story was told at the beginning of the class just before introducing the content was not the appropriate moment. Nevertheless, a question remained -- did the students reflect on their experiences in responding to the story or did they just respond as they would to any other lesson. Even to find this out, I felt a need to make them talk on their own narrative terms rather than prompting them with objective questions. I had a feeling that the answers to the objective questions reflected more of what the teacher wanted rather than what the students felt. However, I continued to bring narratives about my own childhood experiences when I was about the age of my current students.

So, a few days later, after we had been talking about different animals and plants around us, and I had asked the students to write stories about their pet animals, or the other animals or plants they might be very familiar with. When the day came when their stories were due, not a single student handed in a story!

I felt the class needed a good scolding:

Why didn't you write a story for today ? Have you not come across any animals or plants that interest you, that you want to share in the class? Or were you all too lazy to write a story?

The students were silent. Most of them were afraid to look up at me and looked at each other or down at their desks.

Well, let me tell you some of my stories then.

At this point the students raised their heads and became very attentive.

It was a Saturday morning, long ago as I remember it, when I was about your age, and there was a light but incessant Ashar rain. Outside, there was a cacophony of sound of the crows on the big Khari Tree. I joined Nil Prasad, Rajendra, Binod and the other friends of mine crowding at the same window looking out at the crows. There was a burst of laughter as the crows chased Chandra, a senior student, almost pecking on his head. It was Chandra who had yesterday picked up a fallen baby crow and placed it safely back on the tree. Despite that, he had to run from the crows yesterday too. But now the baby crow was on the ground again, wet and helpless. The other crows were sitting all around, making noises whenever people or dogs came near the baby.

Binod said: You know, crows can recognize the people who harm them and take revenge when they get a chance.

As proof of this, Rajendra, who had tried to push the baby crow into a safer corner with a stick earlier this morning, had to run away with the stick whirling over his head to save himself from the angry crowd of the crows coming after him. Binod cautioned him not to venture out again this morning while the crows were still there.

Nilprasad added: Yes, the crows are in a meeting I guess, and they are talking to each other. Probably everyone of them now knows that Rajendra poked at the baby with a stick.

Rajendra was not impressed. Binod challenged him to walk by where the baby crow was lying, but Rajendra asked Binod to lead the way. Binod went outside and slowly walked, hunched over, past the place where the baby crow was lying. The crows made some noise, but he kept walking steadily and the crows did not bother him. Next came Rajendra very quietly, his shaven head covered with a small hat and a stick in his hand, just in case. The crows seemed more excited and made loud noise at the sight of Rajendra. Then Rajendra got nervous and raised the stick over his head. When the crows saw this, they

began to attack. Rajendra turned around and while dashing into the house, one of the crows snatched at him and carried his cap off into the distance. We all roared with laughter.

Binod said: See I told you! The crows know it was you who had poked at the baby crow this morning.

I thought Binod had to be right, that the crows could recognize and remember the people who had harmed them. I also thought that one should walk low in case one needed to pass through that kind of situation.

The story of the crows made me remember and tell another story about a black bull. The school at that time had been a multi-purpose vocational school and had kept a cattle herd to get manure for the fields and bulls for tilling. This bull was different in that it got easily excited, and chased the people it did not like. The most interesting thing was that the bull recognized the people who had been gentle to it and those who had not. It had once, to our great delight, chased Silu Miss, because she had previously yelled at it and had tried to scare it off with a stick. Narayandai was a special person, he was the shepherd, and while he sometimes yelled at the bull, and even chased it with a stick when it was creating some havoc, like munching flowers or vegetables from the garden, at other times he also talked to it softly. To him the bull always responded with respect.

We still had some class time left , but the students were eager for more stories. I told them another story, but with their promise that they would bring their stories next class. This story was about snakes and eels.

A long time ago, when I was about your age, on a Saturday, my friends and I had been going to take bath in the Manohara River which is about half an hour away from the school. On the way there we saw a small boy about 8 years old excitedly

calling his father, who was a farmer. The boy was pointing at the wet field and was throwing a tantrum, but the father was just scolding him. We did not understand what was going on, but we were sure that there must be something going on in the field.

So we stopped for a while and stared at the field. Then the farmer went into the field and after a while he came with what looked like a live snake, holding it by its tail. We moved a few steps back, but were still interested in looking at it.

The farmer walked up to the boy and said: Do you want this snake?

The boy ran away, but as the father moved away with the snake he came back crying and asked his father to kill the snake. The farmer then put the snake on the ground, and the snake slithered. The farmer laughed at the boy who was still pale with fright.

Surprised, we asked the farmer why the boy was crying and why he frightened the boy with the snake. The farmer laughed and said:

It's not a snake at all. The boy mistook a little eel for a snake!

I had seen eels in the fish market, and I think if I were to see them alive and slithering around, it would be difficult for me to distinguish between a snake and an eel. Rajendra told us that an eel can bite too:

It makes you sick and feverish but not dead.

Nilprasad added a bit to Rajendra's bit of advice:

If it bites inside water, nothing happens; even a snakebite inside water will not cause harm, its poison will not be effective. Water washes the poison away, or it will make it so dilute that it will not be effective at all.

Rajendra disagreed: No, snakes and eels cannot even bite inside water.

For the rest of that day, I was extra cautious by the river bank and was almost continuously on the lookout for snakes and eels. After this, I observed the eels in the fish market a little more carefully; they had a smooth and wet skin, their eyes were very small or almost nonexistent. They had fins like those of fishes, and they didn't look as frightening as the snakes.

After the stories, I gave the students the choice to write a story, or to bring an animal or a plant from their home, garden, roadside, or for that matter, anywhere they could find one. Most of the students decided that they would bring an animal or a plant. However, I insisted that they keep the story writing in mind for the next week. They reluctantly agreed.

In the course of my attempts to have the students to bring their experiences to class, I asked the students to write a story of their interest, or an essay or a poem, or whatever they liked to share with me with the class. It did succeed very well in the Vishwo Niketan school, but in the Gandhi school several students brought stories, drawings, and some songs. The stories they brought were not the cultural stories of Swasthani, Ramayana, Mahabharat, or from Pancha Tantra or other folk tales but were mostly of their own inventions. And most of the stories did relate to a theme closely related to the topic we were taking in science class - environmental cleanliness and ecological balance.

One of the students, named Krishna, related the following story:

Once upon a time there was a big forest called Ranivana. It was a very thick forest. There were many beautiful animals and birds. Many colorful birds appeared there. Once a wandering man happened to pass through the forest. Impressed by the beauty of the forest, the man told the villagers about the forest. The villagers came to see the forest. The villagers became greedy and they cut the trees every day and the forest became

thinner and thinner. The animals and birds began to run away from the forest and the forest became a desert. It was time to plant rice, but there was no rain. The villagers realized that it must be because of the cutting down of the trees in the Ranivana. They gathered in a 'Chautari' to talk about the problem. Now, among the gathering there was an educated person. He said: 'You have cut the trees in the Ranivana for firewood and now there is no rain.' So the villagers began to plant trees again in Ranivana. The birds and animals came back to the forest and it again became 'Ranivana'.

Clearly Krishna felt strongly about the conservation of Nepal's remaining forests, aware of the environmental damage and soil erosion that had already occurred in many places in Nepal.

Sumitra's story did relate to one of the cultural traditions or stories in Nepal:

Once upon a time, in a village there lived a man named Rame. He was very proud and did not listen to anyone. He used to think that he was the greatest. He was separated from the society and he was dirty. His home and surrounding was dirty with garbage spilled all over. So he became sick. He had planted rice in his farm. He used to kill all the frogs in his field. So different insects increased in his field. The insects destroyed his harvest. So he did not have anything to eat. He also became sick because of the dirty surrounding of his home. And he died because of the lack of food and his illness.

Both student stories reflected the themes we were discussing in the topic 'Plants and Animals in our Environment'. In a previous discussion the students had learned how frogs protect our land from insects and how our ancestors conceived the story of frogs turning into demons that guard the fields if they are kept happy and appeased. We even have a tradition of 'Byanja Nakegu' -- frog's day when the frogs are respectfully offered rice and

other food . We had also discussed in our class how the animals, birds, and the trees and plants are in ecological balance in nature each benefiting and supporting the others, and thus sustaining the whole environment.

Some days later, I was reminded of another story and related it to the class:

> *One afternoon during tiffin break in my school, when I was a young boy, I was suddenly intrigued by the sight of the moon in the sky while the sun was still shining very brightly. I wondered how come the moon could be seen in the night sky and also in the day sky. Excitedly, I told this to one of my friends, but he was not excited at all. Instead, he told me that he had seen it before, and that the moon actually moved faster through the sky than the sun. I thought about the idea that moon does not shine in the same way that the sun does, and does not reappear in the same place at the same time every day, and it does not remain same distance from the sun either. This made me interested in studying more about the sun, the moon and the other things in the sky. Isn't observation a very important thing in science?*
>
> After the story, there was a pause. I was expecting something that the students had experienced or imagined or wanted to know. While facing the students in anticipation of their response I felt the same uneasiness as before as they seemed to be expecting something from me in the form of instruction. I asked Rudra whether he had ever seen the moon in the sky. The other students laughed. They considered it a silly question and Rudra blushed while he retorted:
>
> *Why not, sir, everybody must have seen the moon sometime?*
>
> I challenged the rest of the students to raise their hands if they had ever looked at the moon carefully. Most of them raised their hands. I approached those who did not and asked:

Myself: *Have you never looked at the moon?*

Ashok answered: *I have looked at the moon, but not carefully.*

Myself: *That is interesting. See, there is a difference between seeing as most of us do and looking as the scientists do, or we could do if we looked patiently and carefully.*

Purna: *Sir, is there water on other planets?* Purna asked.

I replied, letting myself be led off the topic a bit: *I don't know. But I have heard people talk about life on other planets.*

Reena wanted a more definite answer: *Do you believe there are people in other planets, sir?*

Myself: *Do you, Reena?*

Purna jumped in again: *The universe is so vast, there are many solar system like ours in the universe there could be life in other solar systems.*

Myself: *That's interesting, Purna, but how did you know there are other solar systems?*

Purna: *I watch Star Trek. In Star Trek, people from other solar systems come in space ships. They are more intelligent, sir.*

Deepak: *Are there people in Mars, sir?* Deepak asked.

Myself: *Well, so far the scientists have not found any life on Mars and on any other planets. Is not it interesting that there is life only on the earth.?*

Amar was trying to object: *But sir . . .*

But he was interrupted.

Deepak: *That is only a movie, you know..*

Deepak and Purna then engaged in arguments about whether Star Trek's picture of the universe could be real.

Reena asked: *Is there water in other planets, sir?*

Myself: *Well, what do you think, Reena, is there?*

Reena was discontented: *We ask you questions, sir, and you ask questions right back. Why don't you tell us the answers?*

> The bell rang. So I asked the class to write some stories about their observations of the sun, moon, planets, stars, etc. or of water or life on other planets, or whatever they thought would be of interest regarding the sky, space, stars, moon, sun, earth, or other planets.

Again no one brought a story to the next class. Purna brought a scribbler full of biological drawings: animals, divided into various species as would be required for an undergraduate university course. His elder brother was a biology student, and Purna had copied from the book. Nevertheless, the children had started to bring pictures or drawings to class, and showed that they were trying to respond to my requests.

To bring out the narratives of the students there seemed to be other factors that needed to be adequately taken care of. A 'good teacher' is not necessarily a revealer of students' stories. In order to reveal their narratives, I found it necessary to come to their level, to become their contemporary, arguing and talking in their language without showing the traditional authority of a teacher. The stories of my experiences as a student slowly allowed them to come to terms with me, to become liked and accepted by them as a story teller and perhaps as an interested person for their story telling.

The next episode tells a bit more about how school life in Nepal is still continually disrupted by festivals or political upheavals, each of which necessitate changes in the teaching schedules also.

> September 21. Vishwoniketan High School. Today some of the political parties have called for "Chakka jam" which means a strike call for stopping all means of transportation that use

wheels. Traditionally, the strikers would be out there on the street on vigilance against those who do not comply with the call. The government would try to foil the call by sending its guarded vehicles onto the streets, and this would sometimes lead to incidents of stone throwing and stick wielding between supporters and opponents of the strike often involving the police. In extreme cases there might be cases of vandalism such as turning over and burning cars and other vehicles. Breaking of the store windows would be a minor incident in some strikes.

On this day, the teachers had to walk all the way to school no matter where they lived. Since it was a hot sunny summer day, most of them came tired and sweating. A group of students came to ask what was up in school that day.

Ke garne sir? (*What are we going to do?*)

Another student from the group commented: *Napadhne!* (do nothing!)

Yet another commented: *Hajeer garne ani jaane* (Just the roll call and we can go home!)

Shanti Miss remarked: *Well this is how it goes; the second bell will ring and nobody will be in the class.*

I went to grade 7 classroom uncertain about whether there would be any students at all. There were certainly fewer students and to their surprise, I said: *No roll call today!*

Purna: *Sir are we going to study?* Purna asked.

Myself: *Well, why not?* was my response.

Hari: *But there are too few students present today.*

This was a common type of discussion on a strike day -- today, or on past occasions, when I was teaching school. *This is not going to change* ! I told myself.

Myself: *So, what do you want to do today?*

Silence.

Myself: *How about a story?*

Lot of responses: Yes sir, yes sir, tell us an interesting one, sir!

Myself: *Let us pick up from the last story I told you; what was the last story of my experience?*

Dhruva responded: *You mean the one about the snakes ?*

I recalled my story:

Oh, yes, I remember. Well, this happened during the Tihar season (the days near the new year festival in Kathmandu -- the festival of light). I was in grade eight in the Gandhi Adarsha school, a boarding school in the suburban Manohara village. As usual during Tihar season, lots of guys were to be found on the street corners and also outside the school playing "Langurburja" a kind of Jackpot game.

The evening before Rajendra had told us the familiar story about Juwa (a different kind of gambling game) and how a person who possessed a 'Mani' (the jewel on the top of the head of a Naga), won everything he wanted because of the 'Mani'. Another way you can win or at least not lose in a Juwa is if you posses a serpent tongue, he added. Binod added that he knew a person in his village who had won a fortune in a Juwa because he had secretly carried a freshly extracted serpent tongue. These stories were nothing new, but we loved to listen to them when told in a mysterious way late on an evening.

That afternoon, Nil Prasad invited me to go on a snake hunt to get its tongue. I was amazed, since he was considered a chicken in our group. Nevertheless, we were already near an 'ainselu jhadi', a berry bush, where we knew a very big brownish black snake lived. Nil Prasad cautioned me to be very quiet. There was a big circular hole near the bush and we knew that the snake lived in it, for many people have sworn that they had seen the serpent go inside the hole when it was chased. Nil Prasad raised the big crooked stick he had carried, with

both hands raised above the head. He asked me to throw a stone in the burrow. I threw the stone.

Thump! Hush!

Nothing happened, so Nil Prasad poked the stick into the hole. Still nothing happened.

Then there was a rustling sound on the far side of the bush.

We jumped up and ran several meters away from the bush. Nil Prasad was huffing and puffing and was sure that he had seen the snake chasing him. I had not actually seen the snake, but I believed that there was a snake in the bush and that it had chased us.

Enough snake hunt. Who cares about the snake's tongue. We don't have enough money to stake in a Langurburza game anyway.

And away we went, Nil Prasad and I, to amuse ourselves in some other way.

I then asked the few students who had shown up for the class:

Now tell me honestly, do you believe that the 'Mani' or the snake tongue would make one lucky and invincible at 'juwa'?

There was total silence as all the students were looking at me intently.

Myself: *Has any of you ever seen a 'Mani'?*

I have seen one! One student from outside the window shouted.

Meera remarked: *You are not in this class.*

But the boy, who had been listening at the open window had already run away. Nevertheless, the window was still crowded from the outside with other students.

Neera complained: *Sir tell them to go away.*

Reena brought the conversation back to the point: *Sir, it is said that only those people who possess the complete thirty two lakchhana (virtues) can see a 'Mani'.*

Myself: *But then such people with the thirty-two virtues probably wouldn't need the money , would they? Furthermore, such people probably wouldn't want to gamble at all, would they?*

This discussion brought murmurs and giggles in the class. Amidst this moment of lightness and joy Purna stood up to offer me to take to Bockshi Daha (a witch pond) where there was supposed to be a three headed snake.

Purna was pretty sure of his facts: *It is true sir, the whole situation of the pond is something awe bound, chilling silence and scary, too! Every year, people offer a chicken or goat to the snake. Otherwise it sucks up people who come to the pond. There had already been several deaths in the pond.*

I decided to call the rest of the class off for the day. There was a big cheering, both from my students and from the ones outside the window. I threw a concluding question:

Myself: *Did you enjoy the stories?*

There was a chorus of *Yes* from inside the class. But outside students asked me:

Are you coming to our class, too, to tell us some stories?

I was exhilarated: *Yes, sometimes.*

As is evident from the above discussion of some of my experiences of making narratives for the science class, the students in the study schools basically liked all interesting narratives. In the stories they seemed to recognize their own experiences and narratives. But when the narratives came in a formal and closed way, there was a difficulty for the students to interact. The failure to trigger student stories from such preconstructed

stories was because of the student hesitation that their stories might not make any sense and that they might be singled out as comical. However, it was possible to construct narratives that were attuned to the student experiences and their own narratives and aspirations. The narratives that used simple language, and natural experiences that did not claim spectacular achievement or actions were the ones that fall in this category. In the following Chapter V on the students' narratives I will discuss how it was important for the story teller, in order to make story telling interactive and to inspire student story telling, to come to the position of the students in sharing their doubts, in being with them in their beliefs, and in showing that the teller too shares some of their beliefs and confusion.

Chapter Summary

The first section of this chapter was a brief description about the culture of story telling in Nepal. Story telling, particularly telling of religious and, or philosophical stories, is still a very strong tradition in Nepal. Such stories provide a sense of fulfillment of virtuous deeds to both the tellers and the listeners. For example, the story of Swasthani (a mythical story about Shiva) mentions how by undertaking vratta (purification fasting) and telling and or listening of this story helps relieve people from their sin, and fulfill their desires. Such mentioning of what constitute virtuous deeds and their attributes is powerful enough to make people believe, and to dictate rituals and customs. The parts of the story considered important are enacted in many social occasions routinely. Arts and monuments depicting the scenes from such stories are to be found in numerous ways. Several stories, like Swasthani, long or short, enigmatic, philosophical, or purely

entertaining, provide the characters and the ways of living in the society. Thus, naming of people depicted the heroic characters in such stories; places are designated after the important places mentioned in the stories; festivals and celebrations are instituted to mark the important events, and so on. Such interconnection between stories and the society explains why social narratives are retained and used rigorously in the social contexts with the passion and grace of ownership and attachment. Science knowledge though more rationally and logically convincing does not provide that connectiveness to the people and places. It is such connective capacity of stories that is being sought in this narrative approach to science teaching, to help students engage in their day to day activities with an intimate understanding of science knowledge and skill.

The second section of chapter 4 was a discussion of the researcher's efforts to find ways of establishing such connectiveness, to find what types of narratives resonated with the students' narratives, sparked student enthusiasm to engage in science learning, and wove science into their beliefs and decisions of normal actions. This was investigated by bringing the researcher's own experiential stories in the classroom.

Initially, it was thought that a collection of exemplar stories should help the students to bring their stories into the classroom discourses. There was a possibility to recall my experiences as a student or as a teacher and as a researcher. There was also a possibility to construct stories focused to the curricular needs. Since the school contexts for my personal stories seemed rather vague, looking at the textbooks and the curriculum to think about the stories seemed to be a natural approach. However, it was found that such

stories although received well and with enthusiasm did not trigger student stories. There was a difficulty for the students, who were used to traditional way of listening from the teacher and giving precise answers," to constitute narratives in response to the researcher's narratives.

It was found necessary for the researcher as a teacher to suppress "teacherly" posture and to engage in their way of talking to let the students talk in their own way: to trigger the student narratives in the class. This included

- short conversations with simple ideas
- childlike challenges to tell what they know
- letting the students engage in cross questions and answers among themselves
- avoiding direct instruction but providing science concepts as something for them to reflect on

It was also found necessary to continuously provide interesting pieces of narratives in the class so that the students feel it homely to talk about their stories, beliefs and science. Thus it could be concluded here that with above points in mind and with perseverance, it is possible to find ways to bring students' narratives to teach science in an interesting and useful way. It is anticipated that such learning experience would give the students a feeling of ownership and passionate attachment to the science they learned from the class.

The first section in Chapter 5 discusses the classroom circumstances that generated student narratives and how the narratives helped the students engage in various science learning activities. The second section of Chapter

5 discusses various situations of teacher narratives and student responses to such teacher narratives.

Chapter V

STUDENTS' NARRATIVE RESPONSES

Can grade 7 and 8 students write or relate stories that make connections between their everyday lives and classroom science? Do the student narratives make explicit already existing links between classroom science and student experiences, or do the narratives create such links? These are some of the central questions of this study. As is evident from the following discussions on the field experiences, there are affirmative answers to these questions. There was, however, a need to be open to the student limitations, their language, aspirations, beliefs, and individuality. By addressing them with that understanding and with an openness that made them feel confident, it was possible to generate many student narratives relating science with their personal experiences and beliefs and to create a link between science and their social and environmental contexts. The following is a discussion on how these possibilities were realized while being with the students as a researcher and a teacher.

Student Narratives and the Interaction in the Class

After much persuasion and encouraging talks that I thought would be inspiring, students in Vishwoniketan still had difficulty in bringing their narratives to class. Their reluctance and difficulty probably had to do with confusion regarding what to write and how to write. The students had little experience in writing their own stories, especially in science class. I recall one such classroom situation in Vishwoniketan.

July 25. Grade 7 A. I had asked the students to write stories of their experiences that would tie up with what we studied last week. Last week we had studied about the animals and plants around us. There was a confused silence. I thought perhaps I have not conveyed my message, so I tried to explain,

Write whatever you want, a poem, a story, an essay, but it must be about the plants and the animals that you have seen or have experience with.

Bikash pointed at Chandani and said: *Sir, she can write songs and stories.*

Chandani, now blushing: *Is muktak (short lyrical poems) okay, sir?*

Lila: *Sir, her muktak was published in the school journal*

Chandani retorted: *Your poem was also published in the journal.*

Purna asked, after a pause: *Sir, can I write an essay instead?*

Next day in class, nobody brought anything in writing. Lila had written a poem but she decided not to recite in the class or show it to me. Purna did not write the essay. He had an excuse:

Purna: *Sir, I have to do other homework..*

After I gave up trying to get them to relate their narratives for the day, Chandani stood up, and offered to recite her muktak. I encouraged her and she recited:

Chandani: *Maya!*

Kohi bhanchhan -- maya yauta pesha ho
Kohi bhanchhan -- hoina yo ta yauta nasha ho
Tara ma bhanchhu -- maya sadhesatko dasha ho.

(Some say love is profession,
Others say , no it is an addiction,
But I say it is ominous diction.)

Some of the boys cheered in the traditional way of responding to a muktak: *Wah wah wah...*

I wondered how it came about that this grade 7 student composed a love poem. I teased Lila:

Myself: *Your poem is about love too, isn't it?*

She blushed, and remained head down looking at the desk.

The initial reluctance to write or share their personal stories, experiences, essays, or the stories that they might have heard in society may be an attribution of their feeling that they are not the "proper writers." Fair assumption, I thought. Since when did I feel comfortable in writing my experiences and recollections in the form of stories? As a student I had, as did my close friends, an assumption that stories had to come from the imagination in a very connected sequential and comprehensive way -- it is an art of creating fictional episodes -- a story with a purpose and a moral. This is very difficult to do, since it takes a quite a bit of time and effort to think, plot and write.

Nevertheless, the students should be capable of thinking, plotting and writing if they were sufficiently encouraged. The stories by Krishna and Sumitra from Gandhi Adarsha (pp. 118 - 19) in Chapter 4, show such a possibility. I should have been able to get similar stories or poems in Vishwoniketan too. But I was trying to bring out something different, like in the dialogue in class with the students (pp. 120 - 22), something related to their natural way of believing, and their recollection of experiences that would resonate with the science topics that we discussed in our classroom.

However, as is evident from the initial response to the request for their narratives -- the poems, the muktaks and the songs, or the stories of Ranivan, or of the environment -- their narratives tended to address more of their

emotions than concrete connection to their actual experiences. The stories also reflected their efforts to address what they thought were expected to write; to provide answers in a traditional way. For example the environmental concerns in the stories by Krishna and Sumitra reflected the good and bad of environment as mentioned in the textbook. This point was made more visible in the following case:

> July 28. The grade 7 B students have just finished studying about animals, their classification and characteristics. I wanted to determine how familiar the students were with the animals and plants in their environment, so I started the class by writing today's assignment on the screen:
>
> *Write a short essay about the animal that you are most familiar with, or have come across in your daily life.*
>
> After about ten minutes, students started to turn in the essays for quick checks. Dipa's essay read:
>
> *The tapeworm is a segmented animal, it lives in water and through water it gets into the stomach of the animals where it lives as a parasite making the animal sick. The tapeworm is classified as platyhelminthis.*

I asked Dipa: *Have you ever seen a platyhelminthes?*

Dipa: *No sir.*

Myself: *Have you ever heard or seen animals treated for platyhelminthes?'*

Dipa: *No sir.*

Myself: *Then why did you choose tapeworm as a subject for your essay?*

Dipa: *It was in the book.*

Myself: *But the book also mentions other animals, doesn't it?*

Dipa: *I just picked one.*

I thought, maybe the questions I asked were not appropriate. Nevertheless, the topic she had chosen was the first topic in the section of invertebrates that the class just finished.

I then read Vivek's essay:

A dog is a four footed animal, it is covered with fur and it has sharp canine teeth. It has claws. Dogs are basically carnivorous. Some dogs are kept as pets. Dogs are mammals.

I asked Vivek if he had a pet dog. He smiled and nodded in affirmation.

Myself: *What type of dog is it?*

Vivek: *I don't know, it must be an ordinary dog.*

Myself: *What about color, shape and size of the dog?*

Vivek: *It is black, short and stocky.*

Myself: *What do you call your little dog?*

Vivek: *I call him Hakucha (Blackie). When I call his name, he comes running, tail wagging.*

Myself: *Does he know any tricks?*

Vivek: *Yes he does; he can stand on two legs, and can shake your hand.*

Myself: *He almost sounds like a member of your family doesn't he?*

Vivek, smiling broadly: *He comes to sleep in my room. But he is okay, he is a clean dog. If we scold him, he gets upset. Sometimes he does something wrong and his face looks sad and apologetic. Sometimes he even go hiding to escape scolding.*

Myself: *Do you love him very much?*

Vivek nodded and then I asked him why he had not chosen to write about his little dog.

Vivek: *Well, I did not think it was all right to write about my pet dog in science class.*

I was surprised that with all my encouragement the children still did not believe that, in my view, their experiences with their pets were very relevant to science class. After all, were not their pets examples of the animals that we had been studying? Maybe I had, together with all the other teachers they had, been overemphasizing the formal understanding of science and had not tried sufficiently hard to relate it to the students' environment or their daily lives. Perhaps our exams have been focusing also only on the formal language of science rather than on understanding. But the sense of formal language in school science education, that seemed barren for the cultivation of personal and social narratives, also reminded me of the need to be alert regarding the language of my expectations.

How keen and sensitive was I to observe and understand the expressions and the gestures that the others had towards me? Did I hear and realize the things the students or the teachers said? Did I understand the gestures the students and teachers expressed for my purpose of the study? It is hard to tell. I did begin to realize that there were actually many narratives present in my interaction with the fellow teachers and the students. However, these narratives tended to come out more in our unstructured dialogues and discussions, when I did not pose as a 'teacher'; when I did not provide answers or explanations too quickly. When my ideas and my talking were momentarily suspended, creating a pause, the students started to talk spontaneously, among themselves or with me. Such were the moments when their narratives with their passionate beliefs were flowing naturally.

Being careful and sensitive to suspend one's own ideas and explanations while teaching in a traditional school was easier said than done, but it was a knowing to which I went back again and again to bind myself. The result was encouraging: It then became much easier to spark students' narratives and to feel their presence. The narratives, however, never came in the form of complete stories. They were bits and pieces often in incomplete sentences. Nevertheless, behind these bits and pieces, one could sense their passionate beliefs, as if these were simply reluctant revelations of the disjointed understandings that form the fundamentals of how the students perceived the world in which they lived. The following episode shows how a discussion of the topic of gravity brought out the students' beliefs:

> August 23. On this day we had to begin studying the topic of gravity. I started the class with a question:

Myself: *What would happen to us if there was no gravity?*

Harka proposed: *We could fly, because we would not fall down!*

Meena countered this suggestion: *We can fly now anyway, in a balloon. I saw that on TV.*

> Then there were a host of suggestions:
>
> *We can also fly in an airplane.*
>
> *Clouds can fly too.*
>
> *How about the birds?*
>
> I thanked them for their suggestions, but tried to steer the discussion back to the main topic:

Myself: *Well, if there was no gravity we would be just like the clouds, just floating around without having to push or flap our hands. Do you think there would be rain, waterfalls, stones falling off*

mountains. Would we fall down if we tripped? Would we even have to lift things up?

Pause.

Mahesh related my flight of the imagination to his home life:

Yeah, we would not even need to pull out water from the well, we could lift anything!

Suddenly, Amar asked: *Sir, are there fishes up there in the sky?*

Fishes in the sky? What kind of a question is that? What could Amar have been thinking about? I posed a question in reply:

Myself: *Is there water in the sky?*

Amar: *No, sir. but how come fish fall down when it rains?*

There were many giggles in the background. But Amar didn't give up:

Amar: *It is not a laughing matter, you guys, I read about it in Yuva Manch.*

Arun supported Amar: *Yes , I read about it too, in the Gorkhapatra* (The official Nepali daily newspaper).

I had to get a little deeper into this story.

Myself: *So where was the fish found?*

Amar: *Near Babbar Mahal .*

Myself: *How big was the fish?*

Amar: *Not really big but some times they can be really big.*

I tried to pull it all together: *Well, I don't really have an explanation for that. But you know, some fishes can survive dry season by being inside moist mud and when it rains, and the mud turns into puddle, they can come out and live like normal fishes. I have read about such fishes in National Geographic and seen it on a TV science serial too. Well there can be another*

explanation too: rain storm carrying small fishes from the water surfaces of lakes and seas. But what do you think?

None of the children would venture an explanation. But Hari added another bit of information.

Hari: *Sir it is said that a big fish fell down once in Ason and a tantrik turned it into stone. There is a stone fish in the middle of Ason.*

Sure enough, there is a stone fish near the center of the Ason Chowk, the heart of Kathmandu, and it is in a small stone-lined ditch. People pay respect to the fish and it is considered a fish god. People offer rice, water, vermilion color, and flowers to it.

I remembered a legend about the stone fish, and related it to the children:

A very long time ago a famous tantrik calculated by the position of the stars and constellation and planets that something in the form of fish had fallen from the cosmic world onto the earth and that this fish would bring prosperity to the place if it was respectfully preserved at the place where it fell. So the tantrik with the power of his tantra (magic) turned the fish into stone. Also, he had a group of people organized into a guthi (trust) to ensure the continuation of at least one annual service to the fish god. The annual service, in the form of pooja offering; accompanied by music, continues today.

Most of the students had never heard the legend. I don't imagine that many of the students today accepted the story of a fish god, and the idea of giving offerings to it every year, but it's clear that the possibility that a fish might have fallen mysteriously could not be ruled out. Maybe the tantrik had predicted the falling of the fish based on his observation of clouds, wind, and the possibility of a tornado or hurricane.

The class was already full of side discussions on different things, about Bishnu the god reincarnating in the form of a fish, about UFOs, about people from Mars, . . I overheard Meena assert to her benchmates:

After all, who created us all, and who knows what is out there and what can happen?

I let the discussions continue for a little while wondering whether it would be possible to channel this inquisitiveness, the guesses, and the stories of the students into rational and useful scientific discourse. It might have been a good point to discuss the way we could scientifically investigate whether or not fishes did occasionally fall from the sky, and how a storm, or other cause, might have picked them up from the sea, lake, or river.

The problem was, of course, that such classroom discussions do not always relate directly enough to the curriculum, or a teacher would have to be very knowledgeable and inventive to draw the connections. From the traditional teaching point of view, such discussions had to be considered completely useless. And yet, with their enthusiasm, their newfound enjoyment of science class, who knows?

I learned later that the news of fish rain is neither a matter of remote history or unique to Nepal. I came across a Sunday news report of world happenings in the Edmonton Journal in Alberta, Canada about just such a fish rain (Earth watch, The Edmonton Journal, Feb. 27,1993). One suggested explanation given was that strong winds might be carrying along tiny fish eggs that hatch in the air and fall down. But that is difficult to understand since it takes considerable time period for the fish to hatch from the eggs and become recognizable as fishes. The news in Nepal reported that the fish was several centimeters long. Perhaps tornadoes can pick up water and sizable fish and dump them on dry land, far away. But there was no definite answer explaining the phenomena.

Social Context - Generated Narratives

The above story of the 'flying fish' arose in the context of an ordinary science class. There are often other contexts to bring forth narratives from the students. I discovered that the socio-cultural context in Nepal was also fertile ground for inducing student stories that often related to scientific contexts. To bring those narratives into discussion, one needed just to give a small opening. Gathhanmuga, was one such occasion:

> July 18. This was the fourteenth day of the dark moon of the Nepali month of Shrawan; the name of the day was Ghantakarna Chaturdasi, also called Gathanmuga Chahre. This day is celebrated in commemoration of a prehistoric person called Gathanmuga, a brave keeper of the city who kept the demonic spirits at bay. On this day, people perform *pooja* (worship/offering) at home in the evening to summon god to drive away evil spirits from home, people and the community. Different types of nails would be stuck on the doorways and different offerings would be brought out from the houses to a crossroads to entice the demonic spirits away. In the night Gathanmuga would create an eerie silence, punctuated by mischievous shouts and laughter, around the heaps of offerings on the roadsides.
>
> Early in the morning the city bustled with throngs of people selling and buying iron rings which are worn this day as protection from the straying demonic spirits. As I prepared to go out to school I deliberated whether it would be nicer to ride my bicycle or whether I should walk to school. There would be groups of children and teenagers out in the street interrupting the traffic with pieces of ropes or bamboo sticks to stop passersby to collect money for various ceremonies related to the celebrations. I would have to get prepared for the road; it would not be a pleasant day to move out in the street unless I had enough change in the pockets. And I decided it would be safer to walk, since the young people did not hesitate to drag reluctant givers from their bicycles.

When I arrived at the school I noticed that most of the teachers were also wearing an iron ring. The teachers thoughts were also associated with the day and stories about ghosts readily appeared. One of the teachers told this story:

Several years back a friend of mine saw some bokshis (devils) flying with their index finger burning and their hair flowing free in the breeze. The friend hid behind a screen while watching the bokshis. It is supposed to be quite a disaster if they catch you watching them. If they catch a female, they will force her to become one of them, or kill her if she refused to join them. In case of a male, they will turn him into a goat; they will stick a broomstick in him as a tail and take him to their altar to offer him to their god and drink his blood in a sort of communion ritual.

Laxmi, one of the other teachers, brought her own story of seeing a woman who had been caught and possessed by a bokshi. Narendra sir told another story about how one tantrik (like a faith healer) was actually killed in a contest with a strong bokshi.

It was time to go to class. The grade 7 class was working on magnetism that morning.

In the class, many students were also wearing iron rings. I teased them a bit:

Those who wear the iron rings are relatives of Gathanmuga.

Purnima, one of the young ladies, looked shocked and reacted: *You should not say that, sir.*

Myself: *Why not ?*

Purnima answered: *Because the evil spirits will come to get you if their names are abused.*

I told her that I wasn't scared of the spirits because I did not believe they existed.

Myself: *Do you believe that evil spirits exist, Purnima?*

Purnima responded: *Yes I do, Sir. I have seen people afflicted by bad spirits.'*

After we reflected for a few moments Purnima continued:

> *Sir, what does science say about ghosts and spirits? I have read a news story that said that some scientists have studied ghosts and that they found that the ghosts did leave some impression on the negative prints.*

I suggested to the students that good scientists don't bother much about ghosts and don't even try to prove that ghosts do not exist. Most of these beings exist only in people's minds, so if they keep their minds clear, ghosts shouldn't bother them.

The students seemed convinced by my explanation, but I remember when I was young like them, I had stayed inside, hidden behind a screen near the window to peek out at what might come out there in the street in Gathanmuga at midnight. Sometimes I had a sensation of the presence of something ghoulish, but I had never seen anything except the stray dogs, rats and bulls scavenging the Gathanmuga offerings.

I put the discussion on ghosts aside to introduce new the topic: Magnetism, characteristics of magnets, magnetic needles, magnetic direction, and how to make magnets. It seemed to be a big jump from the context of ghosts to the context of magnetism. But as the students pulled out their textbooks I reminded myself that magnetism was once regarded as a mysterious, almost ghostly, interaction itself.

Fridays in the School. In Nepal Friday is the last week day and is half holiday in the schools, the schools close their formal sessions at 1PM. Fridays bring a different mood in the schools. Many schools have different

activities on Fridays such as sports events and spelling contests. The students in Gandhi Adarsha High School where I spent Thursdays and Fridays were often anxious to get into the events -- given a least chance, they start to talk about the sports and events. Fridays often proved to be occasions which led rather easily to sharing stories, generated by fellow teachers, by myself, or occasionally by the students. The following episode occurred a bit later in the term:

> Friday, October 1, 1993. Gandhi Adarsha High School. Many of the grade seven students, who were talking and having fun playing on the far side of the lawn, hid behind the wall as they saw me walking, chalk and duster in hand. When I went inside the grade eight class I noticed only a small number of students present, which was quite unusual. There were only six of them. I had noticed some of the grade eight students hiding in the corridor as they saw me approaching the classroom.
>
> Today, my intention had been to collect the student homework, and discuss to discuss some of their stories. But maybe the students were thinking that the course work was already finished, and that there was nothing important left to study in the class.

Durga, one of the six remarked: *Sir, everybody has gone home, we are only very few. Are you going to teach us today?*

Myself: *Why, what's happening in the village, is there something interesting going on?*

Laxmi replied: *Nothing Sir, but nobody wants to study, they would rather go home and just pass the time.*

I teased them a bit: *Why didn't you go home, did you want to show some extra diligence?*

Gopal: *There is no point, Sir.*

Dhruva: *No Sir, if we go home, we have to work!*

Myself: *What kind of work do you have to do at home?*

Dhruva: *All kinds of work!*

Myself: *Such as . . ?*

Dhruva: *We sometimes have to dig and plow the field, or shovel manure, or cut wood for fuel. Sometimes we even have to look after the cattle.*

Myself: *Are you serious? Do your parents make you work that hard?*

Dhruva: *Yes, most of the time, if you don't believe look at my hands.*

Dhruva showed his hands. They were full of bristles and the skin was toughened.

Myself: *Okay, then we won't study too hard today. But then let's talk about some interesting things related to science that we study. Have you heard about the earthquake in Maharastra, in India?*

Gopal: *Yes sir, about 12000 people were killed and the whole district was almost pulled down to rubble.*

Myself: *Do you know what caused the earthquake?*

Ramkrishna: *Well, it is said that it is because of the pig shaking its shoulders.*

Hari: *That's not scientific!*

Gopal: *It is not the pig, but the man. I mean the god, who is holding the earth on his shoulders.*

I told them a story:

Well, I have heard of a story about the earth resting on the back of a huge tortoise. Once in a while the tortoise changes its position and shakes the earth. It causes the disturbance and we get the earthquake.

The students listened to the story with interest. As we were telling the stories and discussing them, other students kept

> drifting in. By this time there were already 16 students, some from grade 9 and some from grade 7.
>
> I was just ready to tell the students a bit about how scientists study earthquakes and how they tried to find out what caused earthquakes, but then Akhil Sir, the other science teacher in the school, dropped into class. He asked me to come out for a second and then remarked if I did not remember that it was Friday. He teased me: *Are you not going home today?*
>
> Well, since it was already 1:30 PM, I decided I might as well send the students home. Besides, for some reason, perhaps understandable, Akhil Sir didn't appear to want me to stay if he went home.

Group Discussion Generated Narratives

In order to encourage students to relate what we were learning in class with their home life, or village environment, there was a constant need to dissolve the student - teacher boundaries. Even after coming closer to the students to the level of sharing narratives, a boundary of separation between "teacher" and the "students" was felt again and again. There was an ever present need to thin out the boundaries and dissolve them into casual talk before the students could be made to talk out their narratives in a group talk or interviews I held with them near the end of term:

> October, 3. Vishwoniketan High School. On this day, I called together my grade eight students in groups of six for group interviews to get an insight into the contexts of their narratives, and to know whether or not students liked the way I tried to bring narratives in the class. The first group of students came in at 11:00 a.m., an hour before their regular classes were to begin.
>
> Reena and Neetu were already waiting on the verandah when I arrived at the school. When they saw me coming they went into the classroom. However, when none of the other students had

arrived yet by 10:10, I asked them if they wanted to go out into the school yard to play with the other (younger) children.

Reena and Neetu (smiling and blushing): *No, sir, we are too old now for such games.*

Myself: Then come into the staff room for our talk.

Reena: *We are only two, sir!*

Neetu: *I have seen Lal Kaji go to the other room, shall I call him?*

We went to see the next room. There three of the boys, Lal, Bimal, and Shyam, were sitting on the bench. I herded them all into the staff room.

Myself: *Why didn't you come straight to the room?*

Lal: *We were waiting for the others.*

Myself: *Well, you could have come to talk to me?*

Bimal: *We don't know what to talk about.*

Reena explained their anxiety: *Sir, what are you going to ask us? I feel scared that I may not be able to answer. You aren't going to ask us from the textbook, are you?'*

Myself: *No, no, there is no need for you to be afraid. All I want to do is to ask you what you thought about the stories we shared in the class. Did you like them?*

All the students nodded, indicating that they liked the stories.

Myself: *Now tell me ,what interesting views do you have that we can share? What was it about the stories that you liked?*

The students looked at me and at each other, but none of them spoke out. Perhaps they were not used to give their opinion on what a teacher did. So I continued:

Okay, let me start by telling you a story about something that happened to me once when I was young. When I was a little

younger than your age, I had once made a kerosene lamp out of small bottle and a piece of cotton. At first the lamp burned nicely but then the kerosene spilled out from the cotton down bottle and onto the table. I tried to put out the flame but then I knocked the bottle over, and the flame roared up even more. My mom came rushing to the room sensing the fire burning. She covered the flame with her shawl and put out the flame. She then looked at me and slapped at my cheek. I was in shock and started to cry. She then hugged me and began to explain the danger in my actions. I remained startled by the fire; I could not understand how the flames could spread onto the floor and become such a big fire, even though I had put the kerosene in a small bottle with a very small opening? And why did my mom put a shawl on the flame instead of trying to blow it out or put some water on it as I would have done? Do you know why she did what she did?

The students were silent.

Myself: *Do you want to know why my mom acted as she did?*

Yes! They all nodded vigorously.

I explained to them how blowing on the flame, or trying to put it out with water would have created an even bigger fire, and that my mother's wise action deprived the flame of its source of air, and thus smothered the flame.

Myself: *Now tell me some of your experiences that you think you can share with all of us here.*

After a while, Reena told her story:

Well, a long time ago I got my finger cut by a 'chuleshi' (a vegetable knife). You know, I had to help my mom prepare food even when I was very small. I helped her wash the vegetables, the dishes, and help her go shopping for small things. At that time she still didn't let me use the chuleshi. When she was not in the kitchen, I used it and I cut my finger. When I saw how much I was bleeding, I cried out. My mom came and started to scold me instead of applying medicine or binding the wound. Later my brother came and he took me to a medical shop. They

applied some medicine and they told us they had to stitch the wound , but I was scared and I did not want that. My finger still hurts when I push with it like this.

Then Bishwo added an experience of his:

I remember tumbling from the stairs in my house and my head was cut. I was taken to the health post and stitches were applied put in my head, right here.

I wanted to steer the stories towards something that was connected with what they had studied, so I told them another story:

You know, the most interesting thing I ever did was to make a light bulb eyeglass. It is very easy. You take an old light bulb, clean out the inside part and fill it with water. The light bulb can work as a magnifier. This can be used to look at small insects; you can count the number of sections on a fly's leg, or see the different parts of their eyes.

Mahesh jumped in: *Sir, I have used an eye glass to burn a piece of paper.*

Myself: *Where did you get the eyeglass?*

Mahesh: *It was my grandpa's broken reading glass.*

Myself: *What other things could you do with the glass?*

Mahesh: *It makes things look bigger, but not really much bigger.*

Shyam also ventured his opinion: *You need to have very thick eyeglass to get big magnification. I once found an eyeglass with a plastic handle. It was a very thick glass. It did not break even when it was thrown on the floor.*

Myself: *Do you know that you can use such eyeglass to form an image?*

Shyam: *No, sir.*

I went to the cupboard where the lenses and other science equipment was kept, but it was locked. I promised to show them how to make a magnifying lens some other time. The silence prevailed again.

As class time was nearing, the teachers started to arrive in the staff room. As they greeted us they were obviously very curious about what we were discussing. Some of them joined the conversation, but the children were becoming restless. They were probably getting more shy as these teachers all seemed to be listening to what they had to say. Maybe they were also worried that they would not get the seats they wanted in the classroom.

I concluded our group session by trying to keep them interested in thinking about science education, their experiences, and the stories they had in their mind. I promised them that I would show them some of the activities we had talked about, and that we would share more of the experiences and stories of the other children.

Narratives in the Students' Views

> October 10. Vishwoniketan High School. This was almost my last class with the students in grade 7 A in this school. The school is going to close for the long Dasain vacation and after that there is the exam session. There was an unusual silence in the class, but I sensed something going on behind the silence. I proposed that we sum up what we did so far. Reena interrupted my proposal,

Reena: *Sir, we don't study today. We have a program to sing and recite stories and poems.*

Myself: So you want to bid me farewell with your songs and poems eh?

> There was a subdued sound of hustles and passing on of note copies. Lila and Bindu passed a note to Purna. Purna and

Reena argued about who was going to be the announcer. I stood aside trying to figure out what was going on. Yes, the class had organized themselves secretly about what to do in this period.

Reena announced: *Sir, Lila and Bindu are going to sing now, please tell the class to be silent.*

The class became silent without my having to tell them.

Lila started: *Sir, I have written this song, pardon me if there are mistakes.*

I smiled face directed to her but my eyes fixed on the far wall to encourage them to go ahead without making them feel embarrassed:

Myself: *You are wonderful.*

The song started with some initial chowking:

Timi Jandaichhau tadha tadha
Manma kura chha gadha gadha
Farkera heri deu tadha bata
Kehi bhandai chhu ankha bata

You are going far, far,
there are things to be said,
please look back ,
our eyes are saying something.

Several songs were sung in the class in turn. I never thought that chubby Birbhan would compose his own song (sarcastically directed to a group in the class). Nor did I think that Prakash, who never showed enthusiasm to study or do home work or engage in the classroom activities, would write and would sing his fate song. After a while Leela and Bindu asked me to sing. Chandani insisted that I sing or tell an interesting story. Many voices of yes, yes, supported her. I felt at a loss. The whole time I had been asking them to tell or write stories that I thought would be useful and interesting, and now they wanted me to do what they thought was appropriate for the

> moment. But I could not think of what to sing or tell that time. I tried to escape saying it was their turn to bring their stories and songs. They were in total disagreement, but it was already bell time. I pointed it out to them and gave a hearty thanks, and a wish for a better future with their education, and goodbye. Purna was insisting that they would ask the next period teacher to let us continue the session.

Purna: *Anyway, today is the last day and there would not be teaching today.*

> But the bell rang, and I insisted that it would not be good to do that. I thanked them once again and said goodbye. I proceeded from the class towards the staff room followed by the fading sounds of "Goodbye, goodbye, " with lots of giggles and remarks. I looked back from the stairway, the students were still looking at me, they must have been watching me walking away. I waved at them, they waved back and I moved fast upstairs to the staff room.

The experience made me feel that to construct narratives in others' terms is not easy, and that I need further efforts to reach the level where there could be free exchange of narratives with the students. One important thing on the part of the narrative seeker is the sensibility; the eye, the ear, and the mind vigilant to feel and read the narratives that are ever present. Many things in a classroom like situation would remain unrevealed without imaginative, careful and articulate observations. This reminds me of a passage from V. S. Naipaul's (1990) "India: A Thousand Mutinies Now"

> When he had come to greet us, before going in to continue eating, he had seemed casually dressed, a man at home, with a brownish shirt and a many colored dhoti. In fact he had dressed carefully. The shirt was elegant, fawn colored, thick and textured; and his dhoti had a plaid pattern. He fitted into the room, with its walls in an eggshell finish, and the plastic

> flowers in a vase on the window-sill in front of the vertical iron bars: a lot of Mallika's taste here. (p. 117)

Naipaul, a well known author from Trinidad was visiting a 'dalit' (a schedule caste) activist in India. His hasty observation at the beginning was blurred by his notion of scheduled caste being surrounded by poverty and misery. However, as the blurring was gradually lifted what he saw was that sophistication. The passage made me reflect on my own observations of the student gestures, their interactions and so on. The meanings that they might have wanted to present or reveal, and how much of that I actually understood in the hurried pace of my study?

Teacher Narratives and Student Responses

An important first step in studying the narrative approach to science teaching in science classes was to introduce teacher stories to the students so as to open up the possibility for student stories. Most students at the junior high school age are still very interested in stories. However, there were still questions regarding what stories to choose and when to tell a story so as to encourage the appropriate student responses. Traditionally story telling was often associated with the presence of a substitute teacher, or when the classroom atmosphere was such that the students were in no mood to learn seriously. This kind of situation often arises in Nepal when one of the frequent festivals kept a number of students from attending school. Last August 29, one such situation arose, when not only many students were absent, but also a number of teachers.

August 29. Vishwoniketan High School. Today both Mr. Toya Raj and Mr. Yesodham did not come to school. Consequently, the grade 7 science class, which was to be held during the first period, did not take place. The grade 8 students came to spy around the corner of the staff room to see whether or not I had come to school. When they did not see me at the far side of the staff room, they asked the other teachers whether they have seen me. But, before I could assure them that I was around, they hurried back to their classroom. The other teachers gave me broad smiles.

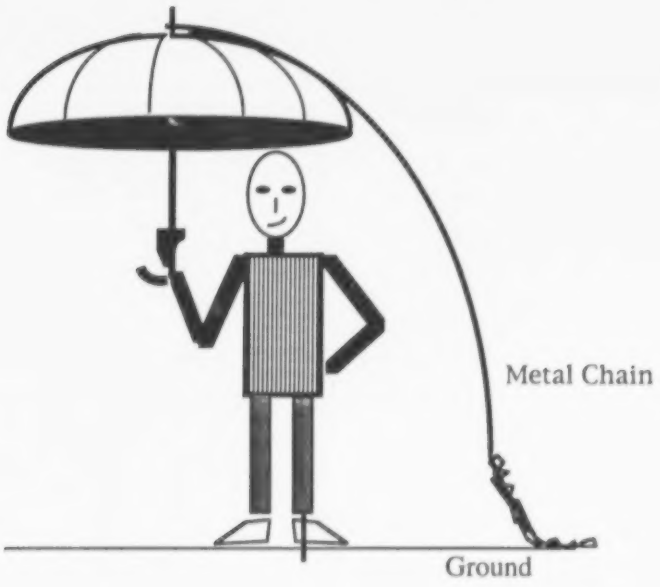
Later on that day, in the fifth period, during the grade 8 science class, there were also fewer students than usual in the classroom. And, in addition, the students did not seem eager to study science. But I pushed them a little bit:

Myself: *Well , if you don't want to do science, let's just talk about science today, and maybe tell a few stories.*

The mention of stories made the students sit back on their benches. I remembered a story that tied into the topic of Electricity and Charges that we were supposed to cover.

Once upon a time, long ago, there was a unique fashion in Korea. The Korean people used to have very fancy umbrellas. But what was really unique about these umbrellas was that each one had a metal chain hanging loosely from the tip of the umbrella on to the ground. As the people walked with the unfolded umbrella in the rain, the metal chain would drag rattling along the road.

Tnen I drew a simple picture, resembling a Korean peasant carrying an umbrella in the rain, with lightning flashes all around the sky, on the blackboard. Some students started to copy the picture, but I told them just to listen to the story.



Myself: *Can any of you think of a reason why this Korean peasant might carry such a funny umbrella?*

The students were silent. They figured that if they waited long enough, I would tell them. However, I was determined to get their responses.

Myself: *What have we been studying for the past week?*

That brought a response from Binod: *Static electricity, sir.*

Can you think of some examples of static electricity?

At this point Purnima vigorously raised her hand: *I know, sir, it's lightning!'*

I was quite pleased, but Binod countered quickly*: But Sir, the chain is not grounded!*

Yes, it is. The chain is dragging along the ground!'

Many voices indicated that the students saw the connection, and were quite impressed by the old Korean fashion with the idea of safely discharging lightning. The students were quite interested to learn also that nowadays many trucks, buses, and petrol tankers drag metal chains along behind them for the very same reason.

I ended the class with some homework for them, and urged them to tell the story to other classmates if they came across them in the village, along with some questions to answer:

1. Why is it safer, to put such chains on the umbrellas?

2. Why would the lightning strike the chain rather than your body?

3. Ask your parents, or friends if they can think of an interesting story about lightning, and write it down for us.

The students left the class talking among themselves about the lightning bolt that had struck the school last year causing a large crack in the SEDU building.

Though the circumstance in which the story came to fit in was not what would be a desirable situation to begin with -- unwarranted absence of teachers and students not wanting to engage in study -- the situation did occur and was not an unusual case. Here, the narrative approach certainly helped to turn an undesirable situation into an interesting session: an illustrative teacher story, teacher-student interactions, and the possibility for students to bring their own narratives.

Although the students who were present had consented to telling the stories and the questions to those who were not in the class that day, the missing students were quite upset the next day for having missed an interesting story in science class. Apparently, those who were present in the previous class did not feel much like telling the stories and the problems to the absent students.

I asked the other students why they did not relate the story and the problems that I gave them.. There was no lack of responses. First of all, it was their own fault for not being there. Secondly, we just didn't see the other students, in the village. Thirdly, we had to do chores around the house. And for those who did find their friends, they had more important things to do, like playing games, and so on. And besides, how could they relate the story and the questions with the certainty and authority of a teacher in a class, who could make the others sit still and pay attention?

Prakash, one of the absentees of the last class, while hiding his face down on the desk ventured: *It's better if you tell us the story, sir.*

I did not feel comfortable retelling the story that day. But I explained the points and the tasks I had given last time, and told the rest of the students to get the detail of the story from their friends. They submitted with silence.

One of my teaching colleagues and participants in the study, Yeshodham Sir had a different experience of bringing narratives in the class (From Staff-room discussion, August 23):

Yeshodham: *When I was telling the students that I was going to tell them a story, they were very interested. All of a sudden they became attentive. It was a story about how one feels when diving into a pool. The class was supposed to be about the Archimedes Principle - the upthrust or the buoyancy of*

displaced water. Well, I told the students that when I was a young boy and often went swimming, I was always intrigued by the fact that when I dove into the water, I didn't have to push off from the bottom to come back up, but that somehow the water pushed me up towards the top. I told them that I even experimented by putting my hand in a bouquet of flowers to see if the water would push my hand up. I also told them that my mother once chased me out of the kitchen when I was putting my hand in a bowl of vegetables which were being cleaned. My mother didn't believe me when I told her I was studying science.

I then asked the students to raise their hands if any of them had the same experiences while diving. Two students raised their hands. I asked them to tell the class about their experiences. One of them said:

When you dive, you get to the bottom first and then you push the bottom with your feet and you come up.

I asked: *What if you don't push with your feet?*

The student answered that he had not tried that. I asked the other student who had raised his hand, and he said that he had the same experience as the other student. I told them to try to let the water bring them up next time they went swimming.

After the story, we went on to study Archimedes' Principle, and the students paid pretty good attention. I think the story helped to create interest in the principle.

In our discussion afterwards, I told Yeshodham sir that I was a bit worried about the students trying to dive into the shallow ponds and rivers in the neighborhood, since there were very few swimming pools, and were much too expensive for most of the students. Yeshodham sir agreed that teachers do have to take some care to make sure students would not try dangerous experiments that might be triggered by some of their teachers' childhood (mis)adventures.

As Yeshodham finished talking about his experiences of introducing narratives into the classroom, Gauri miss joined in the discussion:

Gauri: *There are many narratives that can come from so many students in the class. If you let the narratives come into the class, it will become chaos! How do you keep the order in the class of 70 students? If the students bring the narratives in written form, it might be okay, but if not, there is little possibility for the narratives in the class, unless there are some big changes in our classrooms.*

Yeshodham, seemingly still thinking about his own efforts to bring student narratives, asked: *How about if the students were asked to write poetry, jokes, or other short anecdotes for science?*

Uttara miss added: *But the question is, will all the students have the interests and ability to write anecdotes or stories ?*

At our next meeting, Kamala miss told us her experiences in using the narrative approach (Staff-room discussion, August 24):

Last time I taught about the reptiles in grade 8 D, I told the students about our myth of snake's legs, which are invisible to most people but that only those who have reached Level 32 virtue were supposed to be able to see the legs. And then I explained how snakes actually moved with the help of scaly horizontal stripes underneath their belly. There was lot of side talk and the class was noisy. Somebody shouted:

Miss, there are tiny feet at the end of the stripes. They are so tiny that you can't see them. .

I went near Babita who was now standing and asked: How do you know that snakes have these tiny little legs?

The class was now focused again on our discussion and the noises subsided. Babita said,

I have heard it somewhere, but I can't recall it now.

The class started to become noisy again as the students argued whether snakes had legs or not. Somebody from the boys' section suggested:

Maybe we should bring a snake and see if there are any legs.

There was laughter. I felt rather strained to continue the class the way it was going in that big room with 90 students.

On the next day Rajendra did bring a long snake skin, almost 7-8 ft long. He had found that by the side of the Bagmati river on his way home the day before. This attracted everybody's attention. I was on the top of my voice to get in the control of the situation. I took the skin and showed to the students bench by bench and let them touch it and have closer looks. The other students were all talking about the snakes: how they intertwined, how to get rid of their poison, how they can come for revenge, etc. .. .. It was interesting, but strenuous and also a bit out of control.

In fact, the teacher from the period before complained of the disturbance created by the snake skin in the class. I think the head sir was also not very happy with that disturbance. Maybe, we should have narratives and demonstrations and experiments only in exhibition-like activities.

Kamala Miss's grade 8D was very large, with about 90 students and was usually very noisy. It also had many new or repeating students. The students felt as if they were considered less important by the teachers and the school because of their poor performance. Many of the students there were overaged, and some of them were working mornings and evenings. On the whole, they were more interested in getting the school certificate than in actual learning.

Shanti miss was still thinking about the snake story. She was wondering whether it would be possible at all to convince all the students that snakes don't have any feet:

Particularly, when you tell stories, what basis will there be to prove whether or not a snake has feet. Stories are stories, and one can make his or her own stories, but they may or may not have any scientific basis. Won't it be confusing to discuss stories in a science class?

Apparently, Shanti miss was concerned about the "facts" of science teaching and the authority of 'scientific proof'. It is not easy to shake off that image of "science teaching" and make science more a part of an everyday way of knowing.

Akhil Koirala, the science teacher in Gandhi Adarsha High School was also very interested in relating the things that students do in their home to what they were studying in science class. His story shows the difficulty of getting the students involved in the discussions some days:

> August 26. Gandhi Adarsha High School. I accompanied Akhil sir to his grade 8 science class to observe a typical lesson. Today, he was to teach about the separation of mixtures. He started the class with a question:
>
> *When do you need to separate a mixture?*
>
> There was no response to begin with, but he then gave some illustrations such as the separation of materials when you are cooking rice and lentils. However, the students still had no responses.

Akhil Sir, now embarrassed, demanded: *What happened to you, where did you leave your words and sounds?*

Namrata raised her hand as she spoke: *We look for small stones, and other things and separate them.*

> Akhil went one step further by asking what the students did with water in rainy season when it was muddy and contained lots of unhygenic matter.

Krishna said: *We don't do any thing, we just use the water as it is.*

Babita had a little more to offer: Sir, *we need to filter water in the summer when there is a lot of rain.*

Akhil continued with Babita: *And how do you do that? We let it stand for a while and then the water clears slowly, or else we have to filter it through clean piece of cloth.*

> Akhil Sir then drew a picture of a filtration apparatus and related it to the class discussion. He also drew further analogies with different materials one can find at home to do filtration. He then asked if the students now would be able to carry out such filtration at home to get good drinking water.

The students answered in unison: *We can do it, sir.*

Akhil normally had a special way with the students, and the students respected him very much and usually obeyed him. He had previously had the students clean their class regularly, and had them do home work seriously. This narrative approach was something new to him as well as to the students. He was not happy with the student response that day, but he assured me that they would be doing fine in later classes, provided he was a bit more clear in showing the students what responses were wanted and we have some more sample lessons showing how the narrative approach might work. I too had experienced such a need- a need to teach the students what to do, to write a story, or draw a picture, or tell about . . .. And as discussed in the previous section on researcher's narratives, the students tended to bring discretely isolated stories, that did not always relate to the science concepts being treated that day. Spontaneous outpouring of student personal beliefs, narratives, and ideas were difficult to bring about in such formal, crowded classroom situations, and when they did, they tended to melt the formation of the classes, and spill onto the other classes and the school environment threatening the integrity of the present formation.

It was important to engage the students in the classroom activities while giving them individual freedom to bring their narratives and experiences, but yet there had to be some 'rule' and 'order', so that the stories could be related directly to the scientific concepts being studied.

As a teacher, one needed to be extra careful to detect personal narratives in the classroom discussions. And there was a need to create situations where the narratives became meaningful in the classroom. Special efforts were often required to make the narratives flow out in the natural conversations with the students. For this, there was no definite method or discrete steps to follow, rather there was a need for an attitude among the students and the teachers that would positively orient us towards personal narratives in a meaningful way.

Teacher and Student Attitudes to Narrative Approach

What are we supposed to do?

Do you have concrete examples to show us?

Has this method been tried somewhere? If it is not tried before, then how do we do it here?

These were the issues that recurred in the discussions with the teachers as well as with the people involved in teacher education and school education in general. The teachers, in spite of their intense wish to help me in my studies, were confused about the course I was trying. With no concrete method to follow, no clear-cut stories to tell in the class, no clear-cut steps to follow, the teachers were understandably reluctant at the beginning. I was trying to begin with what I had: a conceptual picture that

once the teachers started to create an atmosphere of sharing their narratives with the students, a 'shaking off' of the apparently rigid teacher-student relationship, there would begin a natural flow of student and teacher narratives. Then what the teachers would need to do would be to weave these narratives together with the science to be taught in the class. The major task was, therefore, to delineate the factors that helped create that classroom atmosphere.

However, to begin with, the situation was such that a teacher was very vulnerable in trying unconventional methods. There were lots of issues that needed to be immediately addressed in the classroom settings - discipline and harmony to maintain; course content to finish; examinations to prepare for; teachers' personal limitations, etc. Even further, a phantom question seemed always lurking, showing its irritating presence at the back of our minds: was this narrative method going to contribute something of value to the educational environment?

Because of the traditional classroom structure, the formal school requirements, and the expectations of students, teachers, administrators and parents, there was often a silent resistance to a new approach. This situation seemed to have created a vicious circle within which many earlier innovative approaches had been trapped, and their essence and vigor squeezed out.

Although there were various reasons behind the way the classroom teaching learning remained apparently static, teachers have developed their own ways to address the situation in a way that suited them individually. Gauri Miss had a powerful approach of enunciating the concepts and explaining them one by one. She made extra efforts to keep track of the

individual students and ensured that they did their homework well. Uttara Miss had an approach of giving her own class notes in simpler language so that the students understood the concepts well. She also prepared her students well for the examinations. In the same way did Kamala, Yeshodham, Shanti, Akhil, Sharada, and Ganga, all have their own strengths. Shanti miss had told me, in one of our conversations, how she had each of the students participate rigorously in the roles of presenter, questioner, and answerer. And I remember observing one of her classes. (See Chapter 3 , pp. 97-99 for the detail) It was a well organized participatory class, and I was very curious of her ability to run the class so smoothly. Nevertheless, it was also observed that in her class, the students' learning was limited within the textbook content even though the topic was about the worms and animals that are so numerous, in Nepal. In fact many of the students could have been infected with the worms.

One of the important problems of the traditional method of teaching is a lack of space for the students' narratives being heard. In the absence of the realization of the potentialities, the student narratives could be a threat to the class. Thus in Kamala miss's class, she had to keep reminding the students to keep classroom order. And even in Yeshodham's class when he tried to be open, pretty severe discipline problems arose. The conflict between the requirement for classroom order and sensitivity to student narratives was difficult to solve.

My observations of some of these classes made me wonder about the potentialities of a more open method of teaching for these large classes of children whose attitudes were not always scholarly. I put this issue to

Yeshodham, Ganesh Bahadur (a teacher educator), and Parshuram (a specialist in science education) in a meeting on September 14, 1993.

Parshuram related a similar example of a class by a Science Master Teacher in the Palpa district in the Western Nepal, The class was being supervised by an international expert: The class that the SMT was teaching for demonstration was apparently very noisy and the students were mostly talking to themselves, and the situation seemed to be totally out of control. The expert however, remarked the class appeared to be very interactive and effective. With this Parshuram perhaps wanted to indicate how from a different perspective a problematic class may appear to be very interactive and effective to an educator who values student interaction. I was not sure whether that was so, so I commented:

> *I don't know if the class was that bad or whether the class was in fact interactive.*
>
> Parshuram retorted: *Well, you can tell by the kinds of talk the students are having.*

Ganga Miss from Nava Adarsh High School was interested in my research question, but she was also very concerned about the problems of discipline in her classroom. She was very frank about her experiences, about her trial of questioning techniques, and activity oriented classes. She gave me one example about such a problem. She had been teaching about friction using a questioning technique. She had asked a question in the class:

> *What if the road is more slippery than it normally is?*

> The response came quickly from one of the more mischievous boys:
>
> How *come you don't know such a simple thing miss? You will slip and fall down on your bum.*
>
> The class, of course, burst into unruly laughter. Later, in the staff-room, Pushpa Sir, a teacher who keeps strict order in the classroom, told Ganga Miss to keep better classroom discipline in the future.

Nevertheless, Ganga Miss and other math and science teachers were not comfortable about the traditional methods of teaching. Most of the teachers seemed to emphasize classroom control and learning to pass the examinations. Then Ganga Miss suddenly questioned why 'our' students, despite the traditional teaching still did not perform very well on the examinations.

Among the students, especially, the concerns about the final examinations, dominated their thinking as the examinations came nearer and nearer. After all, their future depended on doing well on these externally set examinations. The classroom narratives mentioned in Chapter 3 (p. 84-87) dramatically illustrates their concerns. In that episode Vivek, a grade 8 student had sparked a discussion charged with their anxiety for the examination which was just few days ahead. The students were concerned that they were not yet taught science from the textbook Chapterwise in a way to address the possible examination questions. I had difficulty in convincing them that they were taught science content as well and that their course was adequately covered. Later on I was relieved to know that most of the students not only did well in the examination but also their score trend was better.

The narrative approach did succeed in turning that rather tense situation into an interesting session. However, it also revealed a lot about the pressures on the students to succeed: Their parents expected them to do well; the school expected them to do well; the society awaits them coming out with good credentials of doing well in the exams. The situation has created a unique student attitude -- to think beyond learning, of bypassing the learning part, and worry about the examinations. Perhaps, it is an attribute of our situation: getting the credential of succeeding in the exam is the main way to escape poverty and hard menial labor. All the more, it made me realize that I had to show that a more open, inquiring, narrative approach, had to be shown to be effective in helping students do well in the national examinations. Fortunately, most students in this class, including Niran and Suran, did very well in their science examinations.

Chapter Summary

The first section of Chapter 5 elaborated on the student narratives, their contents, types, and orientations, and the circumstances where they were generated. The second section mainly discussed the circumstances of teacher initiated stories and how the students responded to those stories.

One of the important aspects of generating student narratives is an understanding that the students come with limitations regarding explications of their ideas and imaginations and also their prenotions regarding "appropriate narratives" for science class. When the students were encouraged to bring narratives of their interest, they tended to bring poetry, songs, or made efforts to make "rationally correct" type of stories. However,

with a careful approach of suspending "better or conceptually correct ideas" by the teachers and with encouragement to the students by talking about "ordinary" beliefs, it was possible to generate a natural flow of their narratives. It was also to be noted that there was a need to be intricately mindful to identify the bits and pieces of their fragmented narratives. The student narratives always came in the form of fragments of beliefs, preconceptions, and information they have gathered in support of their beliefs and conceptions. There was also a need for the teachers to be mindful of their own preconceptions (as pointed out by Berg and Brouwer, 1991). For example, a science teacher who might have missed the actual news of fishes that fell with rain might consider such idea a myth. But such unusual things are of great interest to the students. I found the students, at least collectively, were more informed of such things than myself or the other teachers.

Besides the important teacher aspects of generating student narratives, there are some circumstantial aspects which gave contexts for outpouring of student narratives. The social contexts such as celebrations of particular festivals, or undertaking customary rituals, both of which are so numerous in Nepal are good examples in this regard (see pp. 142-144). Similarly, more relaxing school days such as Fridays, are also good occasions to get in natural conversations with the students with interesting social, and personal narratives (pp. 145-147). Student activities such as presentation of stories and pictures in the classroom, or collection and exhibitions of animals and plants are good opportunities to listen to the student narratives. Such moments of student activities also presented occasions to feel how strongly

the student preconceptions are rooted in their beliefs and how passionately they are attached to their beliefs.

Student responses to teacher narratives were found to be positive, however teachers felt some constraints in initiating the narratives in a science class. Usually, the teachers are under intense pressure of having to finish the contents from the textbooks, often having to follow page by page, in order to satisfy the students that they were led through the content requirements to face the examinations. Using other methods of instruction was filled with anxiety. The use of the narrative approach was also received with similar anxiety at the beginning. However, in the course of time, the science teachers participating in the study also started to try their narratives in the class. Their initial narratives, like the researcher's initial narratives, were devised to directly link to the science contents. However, such narratives gradually led to other narratives that are interesting and useful for classroom discourses.

The narrative discourses in the class generally caused a more noisy environment, which is imaginable given the large size of the classes (over 70 students in each of the classes). This supplemented the anxiety of the teachers in using the narrative approach. In the traditional expectations a good teacher is the one who can maintain pin-drop silence in the class. In this context, it is also understandable why the cooperating teachers often desired to have a readily available collection of interesting stories to tell in the class. Thus it was necessary time and again to assure the teachers that the noisy situation in the class could be more constructive and desirable from the students' learning point of view.

To sum up, when students are approached at their level of normal talk, their narratives become readily available. For this, there is a need for the students to be in their own space -- a secure space to hide-and-seek while being unsuccessful or successful while bringing their narratives. It is important that teachers cooperate with the students in the understanding of their constraining limitations. Over and above, it is important that people concerned in school education realize the importance of letting the student narratives come in the classroom discourses for effective and interesting learning. For this there may be a need for a change in the attitudes of all towards the traditional values regarding what constitutes a good teacher, and what makes for effective classroom teaching, and effective and meaningful examination of the students.

Chapter VI

TEACHER, STUDENT, AND HEADMASTER RESPONSES TO NARRATIVE APPROACH

This research was initiated with the central question: "How effective is the narrative approach to science education in creating bridges between school science and the students' lived-in contexts?" The effectiveness of the question cannot be measured on a simple scale since several factors are involved in the complex dynamics of school education. However, several feelers could be devised to have an idea of the effectiveness. This chapter is intended to analyze those feelers in evaluating the effectiveness.

The important feelers regarding the feasibility and effectiveness of the narrative approach are associated with the following questions:

- Can the researcher and the participating teachers construct narratives for science classes that resonate with student experiences?

- Can grade 8 students write, or relate in a non-written context, narratives that make connections between their everyday lives and classroom science?

- Do the student narratives make explicit their sociocultural or other everyday beliefs?

- Does the narrative approach help link classroom science to students' sociocultural background, or do the students' and teachers' stories create such links?

- What are the teachers' and students' attitude towards such a narrative approach to science teaching and learning?

These questions will be addressed based on the personal observations, teacher interviews, student interviews, interviews with the school administrators, analysis of the student and teacher narratives, and personal journal.

Finally, the chapter will try to analyze the characteristics of the narratives that link school science to the experience of students and give an outline of successful stories, and explain why they are successful and what kind of contexts students use in writing such stories.

The teachers, the students, the school administrators and the researcher are the main actors in this study, each playing different but equally important roles. The evaluation of effectiveness cannot be perceived without the attributes of these actors. Therefore, this chapter's organization focuses on each of the actor groups' responses: responses of the teachers, responses of the students, responses of the administrators and the personal reflection.

Teacher Responses

To begin with, teachers were apprehensive of the narrative approach, yet they could see the benefit of using stories and experiential narratives in teaching science and some of them were already using narratives in one way or another. The response of Toya Raj in the following dialogue in one of the initial teacher meetings highlights this situation.

Toya Raj: *Usually, if I started the class telling the students that I was going to tell them an interesting thing about the topic, they became attentive. And in fact they remained interested whole of the class if the course content was blended with interesting contextual stories. This was easier with the previous textbooks, in the older system of education, in which interesting contexts were often blended with the science contents. Now the textbooks are like the "ghoda ko lagam" (saddle and whip without the horse). There is no interesting beginning. The class begin with normal noise and disruptions. I then start with an interesting story such as in the case of Archimedes principle, the story of Archimedes running out of bath tub. You start telling a story, they become interested but at one point you have to teach the text and they become distracted, and they start to make all kinds of trouble. But you need to have stories to begin with and when there is no story, what do we do?*

Myself: *How about the student stories?*

Toya Raj: *When we ask the students to bring stories, they may bring "Lal Hira" stories (stories from the book) or the stories of the phantoms and demons told by their mothers. How can we accept those stories in the class?*

Myself: *Why not if those are the stories that are in their mind?*

Kamala: *How do you tackle such stories of 60-70 students?*

(Teacher workshop meeting July 26).

In Kamala's comment I also sensed the strong concerns of Ganga Miss, Akhil Sir, and Shanti Miss in the workshop meeting on the previous day. They had pointed out the limitations of the present classroom situation, the need to keep the students under harmonious control, the need to finish the course contents, and the need to show that their science teaching is good by producing good pass percentage of the students in science. Their argument was that the way they were practicing their teaching style of text

reading and frequent references to examination questions was a necessity in the situation. In Ganga Miss's words:

> *It was not that we are unaware of some new methods such as questioning method, interactive method, or the methods with hands - on activities, but that these methods generally created situations where it was difficult for us to continue because of the impossibility to get the class under control, to satisfy the headmaster and to accomplish content learning in a smooth progression. The way we teach -- text learning, and note giving is just the best to address the current situation.*

At the end of the meeting, Gauri Miss was reminding me of their uncertainty:

> *Sir, we cannot promise we will follow your new approach. Let us see, observe some of your classes and then may be we will. But anyway it will take a lot of time, won't it?*

She was supported with the nods of Kamala, Shanti, Tripathi and Uttara.

I proceeded with the study guided by the following comments I made in the workshop meeting:

> *I think we agree on one point -- that we are so hedged in the current situation to feel that we cannot do any thing new. My proposition is to let us see if we could come out from that whirlpool-like situation through the narrative approach.*
>
> *I don't have definite steps to follow right away. My plan is to generate a way as we go along teaching science with this mental openness. I will be teaching science regularly as you will but perhaps with a lesser teaching load so that I can also concentrate on my study aspect. The first strategy, to note the presence of our stories and student stories, is to tell our own stories and help the students bring their stories that are related to the science we teach. For example, we can tell the mythical story of Rahu getting hold of Sun and Moon during the eclipses. What we do during eclipse and why we do that would throw*

some light on our cultural inclinations. We can ask the students what they do in their homes and let them talk about their experiences, beliefs and what they think are the realities.

Let us see what we can do. May be we can talk about our stories and then open them up for guided discussions, may be we can give turns to the students to tell their stories, or ask them to write stories and then turn them over to us. If you don't have time to go through them you can bring the copies to me. This time, I have more time as a researcher, I am not engaged in various other things in school or at home as most of you are. But let us try to evolve some way that would be useful for the situation. I think that is our reality and that we must face and try to change to a better way.

Sharing the Views on Narratives

We enjoyed talking about the stories and the personal narratives of experiences. Whether it was discussion like that in Vishwoniketan with Devi Miss and the other teachers in the staff room(see Chapter 3, p. 67-68), or with Guruba in Gandhi Adarsha (see Chapter 3, p. 72-73), or with the teachers in the Prabhat High School (Personal journal, Nov. 11), or with Ganga Miss at her home, (Interview, August 22), such stories and experiential narrative-based talks usually provoked passionate discourses with the teachers. Following the association by Polanyi (1968) of scientific endeavor to the scientists' passion, the passion towards the narratives could be associated with the true interest and concern of the participants of the discourses. This could partially indicate the importance of the narrative approach in our Nepalese context.

One aspect that stood out from the discussions was the realization of the presence of the immense mass of mythical stories which came in the form of small fragments scattered here and there in the discourses. Thus in

normal staffroom talk, a teacher when asked whether he believed that the crows don't die a natural death, could with natural ease reply that "it was said so" (Chapter 3, p.70-71). Or teaching colleagues point to the issue of reality referring that it would be impossible to prove that snakes don't have feet since the feet could be seen only by the person with thirty-two virtues. This situation has created a situation of suspended beliefs -- it was never decided once and for all that snakes don't have extended memories or that snakes' eyes don't capture the images of those who try to hurt them. Such situations created a neutral ground where all kinds of beliefs and conceptions could be accommodated for discussion.

Holy scriptures and great epochal writings such as the Vedas, Upanishads, Mahabharat, Ramayan, and many treatises of Buddhism stand as mountains in the background to remind people of the immense knowledge accumulated in the distant past. And like stories about mountains and forests, there are all kinds of speculative knowledge attributed to them. One very popular notion about these scriptures is that they embody all kinds of knowledge possible in the past, present or in the future. And that the times of those scripture were the highest level of human development materially, socially, and ethically. Thus it was not at all astonishing to hear from Yeshodham Sir (Personal journal, August 22) that in the time of Ramayana and Mahabharat modern science was already developed to produce the "Brahmastra" (atomic bomb), and the "Kchhepyastra" (missile), the "Door darshan" (Television), the "Vayuyana" (airplane) etc. If wishful imagination and perception and identification of the forms to meet the imagination were to be considered, then there seemed to be no limit in these epics and the

great scriptures. One needs to be mindful that these epics and scriptures are often read and heard in our society with much reverence, as something beyond science and social contextual issues. Often my attitude was not to question the issue of reality of these epics and sutras. These are considered beyond the grasp of the ordinary mortals and too holy to discuss. This reverence could be a power to maintain a respectful place for such knowledge and this could also extend to any other knowledge inherited from the past.

Some Initial Teacher Narratives in the Classroom

Although at various instances the classroom teaching by different teachers created situations for generating teacher and the student narratives, there were particular reasons why some situations were more conducive for narratives than the others. For example, in the following observation of a classroom by Yashodham Sir, it seemed that he approached the science class with an openness towards student narratives and with a motivation to stimulate student narration.

> August 20. Vishwoniketan High School. Observation of a class by Yeshodham Sir at grade 8 A. Yashodham Sir was teaching about respiration and his approach was to question and to explain with short experiential phenomena such as what would happen if we close our nose for a while?

Yeshodham: *Depending on the evolutionary stage, different animals respire through different parts: fish through gills, man through nose. Insects through?*

Prakash: *Through pipe.*

Yashodham corrected: *A kind of respiratory tube. What is the name of the tube? Trachea. How about the plants? Plants have stomata through which they respire.*

Bikash: *Plants give out oxygen and take in carbon dioxide.*

Yashodham: *No that is different that is the process of photosynthesis and takes place only at daytime.. When do plants respire?*

Bikash: *In the night time.*

Yashodham: *How about you, when do you respire? All the time? So must the plants respire all the time! So if you are asked when do the plants respire, what must you say?*

There was a huge hum in the background. Students were talking to themselves in subdued voices, a student starts to play with a watch. Another was making a paper boat. Yeshodham Sir picks up the watch and questions the student if he was also listening. This student nodded his head in the affirmative. Yeshodham then asked Binita to recite from the text.

Kamala was asking whether the ants have noses. Four comrade students across three adjacent benches in front of me were engaged in a conversations: *How do ants respire?* one asked. Promptly another answered: *Pipe, Pipe, mula.* An argument ensues: why did you call me mula? Exchange of some blows. Another from the camaraderie asked: *You know what that pipe is called?* And gave answer himself, without waiting for the others: *Trachea trachea.*

How about Amoebae? Another student was getting more inquisitive.

The hum was really disturbing, but the student discussions were not pointless. Yeshodham was bringing more argumentative points but he had to speak out on top of the hum that persisted. The period was almost coming to the end, Yeshodham was trying to gather the important points. He went on to explain that respiration was necessary to get energy.

You must give attention to one thing: when you are exercising, then you must respire very fast, when you are running, then also you must. In the test if you are asked to write about respiration system what should you say?

No answer.

In the discussion with Yeshodham Sir that followed the class, he told me that although exhaustive, he enjoyed the class; telling and listening to the interesting things about respiration. Yeshodham Sir did trigger some students responses, but the classroom situation made him exhausted and perhaps the feeling of having to complete the content made him feel a need to make someone recite from the text. He could have brought more interesting stories, such as about the pulmonary problems, that were such a big issue in Nepal, or air pollution, or the problem of the kitchen environment with wood burning stoves. But to discuss such things in the class, one need to have confidence over the classroom situation, and confidence builds up only with actual experiences. Nevertheless, Yeshodham Sir's effort was not pointless: although the students were talking, and there was hum all the time they were mostly talking relevant things. There was a slight methodological problem involved -- of acknowledging and addressing the issues raised individually or by groups of students. His second narrative approach, recalling the experiences of swimming to teach buoyancy of water (Chapter 4, p.158-159) went more smoothly.

Kamala Miss's narrative approach regarding the snake (Chapter 4, p. 160-61) was on the surface even more disruptive in that more noise was coming from the science class. Her story was about a myth that snakes have legs that were visible to only those perfectly virtuous people, people who

possessed the 32 virtues. This story sparked many ways of experimenting to see the validity of the statement that snakes had legs. But it was a very successful class in that her approach provoked passionate dialogues among the students and also stimulated them to act. The next class some of the students had brought a discarded outer shell of snake skin to show in the class and that caused more discussion.

Akhil Sir's efforts to bring in the narrative approach was to link the home situations with the topic concerned (Chapter 4, p. 162-63). Akhil Sir was trying to bring out student experiences of mechanical separations of mixtures by various methods. He gave some examples such as the possibility of extracting sugar from a dust-mixed spill of sugar on the floor, the example of extracting clean drinking water from the water collected from a *Kuwa* (a shallow well) during monsoon time. The example of the mechanical separation of mixtures such as sugar and floor dust did not provoke a passionate discussion. But his telling about the snakes, the types of snakes available in Nepal, and how to distinguish the poisonous categories from the non-poisonous not only provoked an interesting discussion but the students even brought drawings of snakes and stories about them to the next class.

For Shanti Miss, it was difficult to let the students talk in a free and unformed way since the class would apparently appear unruly in such cases. Her classes were usually very neat -- students were given turns to recite their writing, and to question and answer, their copies were routinely and systematically checked. Gauri Miss was known for her clarity of the concepts she taught and the seriousness with which she emphasized hard

work by the students. Students respected her very much because of her dedication to take them through the course requirements.

Nevertheless, both Shanti and Gauri did relate some of their stories and experiences, in a way to provide illustrations to some of the phenomena they taught such as Shanti's observing of how a person was electrocuted while trying to change a fused wire:

Shanti Miss: *I told this story at grade 7B while teaching about electricity:*

> *One afternoon I was waiting for the bus to get back home from school near Rastriya Nach Ghar (Theater) by the side of Ranipokhari. Some people from the office of electricity supply were trying to change the fuse wire. One of the person was atop a wooden stair case reaching to the main-line others were helping him from below. All of a sudden this person atop the stair seemed to get into a fit of shaking. Suddenly he fell down as a dead log. People rushed him to hospital. That was horrific. I guess the person was dead.*
>
> *When I told this to the students, they listened attentively. I then told them the uses and danger of electricity.*

These initial narratives brought forward many aspects of classroom teaching and learning requirements that a narrative approach must address. First, the limitations and possibilities of narratives have to be assessed based on individual teacher's orientation and personality. Second, the classroom teaching effectiveness has to be tied with the total school environment such as a need to restrain the student activities that might cause disruptions in other classes and a need to address the traditional curriculum requirements. These were very significant problems in that the possibilities of bringing a change in the traditional curriculum expectations and requirements were

extremely difficult in the Nepalese contexts, and that the physical structure of school and classroom were also in distressingly bad shape and not conducive to lively discussions. The following sections discuss in more detail how the narrative approach fared in these contexts.

The Classroom Management and the Narratives Approach.

The contexts of the schools were such that even a small deviation from the traditional way of teaching and learning could cause tremendous tension. The participant teachers, Kamala, Yeshodham, Shanti, Akhil, Gauri, Uttara, and to some extent Toya Raj were extremely concerned of one thing -- how to maintain a satisfactory classroom order during the teaching periods. Basically, the classrooms were always at the verge of chaotic breakdown because of the high number of students (70 - 90) in a limited and fixed space arrangement of a class (see appendix III). The use of student and teacher narratives in such situations was carried out with conspicuous risk. -- the risk of letting the situation get out of control and its spilling over into the total school environment. And this happened in Kamala Miss's class when the students brought the snake skin to the class which sparked many discussions filled with passion and curiosity but also created enough noise to disrupt other classes. This also happened in my class, when I was telling stories in grade 7 and 8. The students from the other classes tended to flock around the windows of my classroom. The laughter, and the passionate discussions were also infectious in creating waves of problems in the school environment.

Popular activities such as students' hands-on activities, science shows, and fairs, though much desired by the students, teachers, administrators and

parents and also by the education promotional institutes could not be run on larger scales because of the economic costs, time and efforts of the teachers and the demands on school facilities. Moreover they were potentially disruptive to the traditional way of schooling. Therefore there always had to be a powerful reason to make such events come about. This year such occasions came several times both in Vishwoniketan High School, and Gandhi Adarsha High School sparked by the research study approach. Three days of students' competitive science fair activities in Vishwoniketan High School were the most notable of all such activities during the research period.

This science fair was held immediately after the long Dasainn vacation from November 8-10, so that it would not cause major problems because during that time there would be fewer students coming to the school and fewer routine activities to carryout because of the preparations for the final examination. A few days before the fair began, the participating students from grade 6 -- 8 were busy making models, cutting cardboard, painting, cutting plywood boards, arranging science education apparatuses for gas preparations, for electricity, for hydrodynamics, for light, magnetism, heat and so on. The students were humming like bees darting in and out of the science fair room. Many of the other students who were not participating in the science fair were also humming due to curiosity. The windows to the science room on the verandah were always crowded with onlooker students, most of whom had deserted their current classes. The noise, laughter, shouting, and running of the students was presenting a busy celebrant science fair mood disrupting the school environment of discipline, obedience

and formal classes. It did not match the traditional expectation of proper school conduct. Finally, the headmaster called me to suggest if it would be possible to keep all the activities inside the classroom and whether it would be possible to keep the non-participating students engaged in the classroom. The other teachers were concerned too for they were told by the headmaster to keep their classes going on as usual (Journal, November, 10). All of us made extra efforts to keep the school running smoothly with formal classes, but with some lack of success.

From the above discussion, the apparent loss of classroom order could be viewed as degeneration only from the traditional perspective of an ideal classroom where the students remain silently recipient, well disciplined, and well behaved towards the teachers and the school authorities. Otherwise the type of discourses that were released in these activities were desirable for the students' individual cognitive learning. Nevertheless, the infectious noisy activities did certainly pose a problem to the school environment, and the effect was considerable because of the space limitations, and the limitations of the physical construction of the classrooms. There was clearly a need for a middle approach: enhancing constructive discussion and an open atmosphere but mindful of keeping the area of discussion limited to the classroom or the science laboratory room.

Constructing Narratives for Science Teaching

Although the teachers were interested in taking the risk of trying narratives in the classroom, they often felt unsure of how to get or construct narratives. In the interviews and in the informal discussions, the teachers often repeated concern for the lack of stories collected for this purpose. In

the staff room teacher meeting (October 14), Yeshodham had said: *Maybe we ought to have someone prepare a compendium of stories for use in the classroom.*

When I explained that such compendium may come as burden by becoming another text to teach, Gauri, backed by Shanti and Kamala, said: *Then give us some example stories.*

I recalled the classroom discourses involving the stories of the crows not dying natural death, the rainbow and the fish rain, the snake, and the story of the magnet.

Shanti Miss was more inquisitive, she asked: *Tell us how many topics have you taught in stories?*

Myself: *In class 7 A, I have so far used two constructed and 5 experiential stories. There are however, some problems in storied teaching. Basically when you teach through stories, the teaching and learning tend to go in depth. For example, when we tell the story about the snakes, we come across so many things that are not in the course requirements and yet so interesting that they tend to guide our discourse in those directions. However, the students seem so interested that they easily learn such extra material, as well as the required material.*

It is understandable in the Nepalese context that teachers have little time to get tied up to thinking about narratives all the time and therefore, there was a desire to get some quick examples. The difficulty for me was that I wanted to bring the point that it is not desirable to have example stories since if isolated stories were brought in the class for teaching science the stories themselves would come as extra content for the students to learn

instead of the stories helping to engage them in constructive interaction and sharing.

The question of example stories also arose in the reflection on the research prior to the field study and I did make an effort to make example stories to be used in different topics of the text books. But these stories turned out to be difficult to tell in a way that fitted normal story telling; instead they seemed to stand as formal discourses not different from traditional classroom discourses. How to search and use the narratives of the students and the teachers befitting the classroom work then became a major focus of this study. The essence of this focus was to see how to make it possible for a natural introduction of narratives to make teaching and learning more enriched and democratic. And it was found that a teacher's personal attentiveness and ability to quickly pick up the student narratives were important factors that determined the adequacy or inadequacy of the narratives.

Narrative Contexts and Believability

All of us trying to bring narratives in teaching experienced one problem: The narratives tended to sweep us to a different plane than what was necessary in terms of the text content and the course requirements. The realistic understanding of a crow's life, or of a snake, or of the fish that fail with rain, and of rainbows, were not parts of the course requirements nor were they important from the traditional curriculum point of view. Some of these problems were explicit in the following experience of Shanti Miss.

Shanti: *I normally use a class presentation method. Perhaps there is no way we can use stories in that. It is difficult even for us to construct narratives, so, how can we expect the students to*

make their narratives? We cannot make narratives in all the subjects. There are only a few which can be used. For example, I have one story about an electrocution that I have seen. I think that story could be interesting to tell in the class for electricity. But one problem in this is that the story tends to take in a direction different from what is there in the text. The story is related to electricity but ..

Guari commented: *This could be useful just to make the class interesting and to motivate the students. Certainly, the kids will be interested by story telling. But, when we tell such stories to the students they will bring lots of similar stories. Now the problem is their stories and experiences may divert the whole class in a different direction. The problem is, do we stop or continue the stories? Those things are useful but where is the limit?*

Shanti continued: *The other problem of the stories is that many things told in the stories come in an artificial way i.e. there are things that could be artificially constructed to tell. But it is very difficult to construct and tell artificial stories -- stories and the narratives that are not experienced. It becomes obvious that the story is artificially constructed.*

Myself: *You mean, such story won't have trustworthiness (authenticity)?*

Kamala argued: *Yes, they won't be believable. How do we count on such stories in a science class? I think this is one of the differences between science and stories. In science everything needs to be proven experimentally. Not in the stories.*

The believability and credibility of ordinary narratives of the students and the teachers is really an issue when perceived from the space of a science teacher who is supposed to teach science. There were always tempting questions of the purposes of science education: What is the value of what is believed or not believed in society or in a science class? Is not the science class supposed to teach science concepts, the more authentic realm

of knowledge and rationality, in order to eradicate those beliefs which are irrelevant in the modern world?

The issue of the credibility and the controversy of personal narratives arises in the face of current curriculum practices where completing text reading and understanding the text in a way such as to reproduce it in the test was highly important. On the contrary, when we view the situation in terms of the richness of learning based on the students' own language, beliefs, and experiences, those things shine out as important attributes of the narrative approach. Can science replace the individual beliefs and commitments of the people? As discussed in the previous chapters, there are now strong arguments indicating the need of addressing the limitations of looking at the science education through formal and sterile ways and the importance of personal narratives in science education. But to bring these ideas in the discourses of school education, and in the language of the teachers there is a need to continue further studies of the narrative approach.

Blending the Stories with the Classroom Discourses

My own conclusions from teaching through the narrative approach was that it was provocative, interactive, and regenerative. The number of narratives that were generated was incredible. For example, in a class I started with a story of rainbow from the point of view of its Nepali mythical meaning, the students became quickly interested and involved.

> August 24. Vishwoniketan High School. Grade 7 A. Today I thought of giving the students a narrative about "Indradhanus" (rainbow). The literal meaning of the name is Indra's bow. Indra is the king of the heaven and is custodian of rain and thunder. As a child I had heard stories of how the rainbows

sucked water up to the sky from big lakes and seas and rivers to make rain. So I started asking the students:

Myself: *How many of you have ever heard stories about the rainbow?*

Many hands were raised. I asked Purna to relate the story.

Purna told the same story briefly stating: *Sir, it is said that rainbows suck water up to the sky to make rain.*

Myself: *Who makes the rain?*

Lots of voices: *Indra*

Arun quipped with scientific tone: *Sir that is nonsense isn't it? There is no Indra or anything. How can water move up?*

Lila jumped into conversations: *Why not? How come rain falls from the sky?*

Reena started to explain the water cycle in a low voice but was cut short by Prakash who demanded: *Then how come even fish sometimes fall down from the sky?*

Purna said: *Sir may be we can go to the place where the rainbow dips and then see if it really is sucking up.*

Meera jumped into the conversations: *I have passed through rainbows when traveling through mountain highways. It seems to move away further and further as we approach it and suddenly disappears and then another one appears at a distance. Sometimes we could even see several rainbows at the same time.*

I supported Meera with my own experience of traveling along a highway on a day of rain and shine and seeing many rainbows.

Niraj quickly remarked: *Sir, it is said that jackals get married in such days of rain and shine both. Is that true?*

Everybody laughed.

> By now students had started to argue and counterargue among themselves discussing their experiences of seeing rainbows, some emphasizing its water sucking characteristics, others trying to argue that rainbows show the phenomena of internal light reflection. There were talks of heavy rain, flood in Bishnumati and Bagmati, the two notable rivers in the valley and so on.

In most such occasions, the number of narratives brought by the students, though in fragmented forms, was rather high in number. Each statement or question made by the students carried stories in itself; worked as windows to look into the individual lives. However, there was the possibility of overlooking many of the possible stories, it was difficult to address all the narrative fragments brought by the students. It was also possible that a few of the stories could sweep the whole discussion in a different direction.

One important point regarding the narrative approach is the need to identify potential narratives and the actual narratives blended in the language of the classroom interactions. When carefully listened to with appropriate sensitivity and mindfulness the student stories provided many openings for further learning. But this may be difficult in a situation of regular teaching as a professional teacher who has the responsibility of not only giving a moment of satisfaction and insightful learning but also to mind the formalities of school education, the content, the examination, the period of classroom teaching, the homework, etc. For one who has to live in the paradigm and survive if not thrive, one would be very much preoccupied with the maintenance of classroom order, the accomplishment of the defined duties, and presenting oneself as a "teacher" in traditional sense. There may

therefore be a need to change the values of classroom order, duties, and the role of a "teacher" to blend narratives in a class.

During the narrative discourses, there were moments of high importance and moments of less importance: at certain moments students were more attentive and interactive than at the others. Mostly, when the stories come in the form of unfolding some new thing, such as experiencing travel through rainbows, experiences of touching a snake, telling about whether the crows die naturally, whether the snakes register the images in their eyes, students looked at the teacher attentively. These were also the moments when the incessant hum in the classes stopped. Other moments, the moments when a proposition was already made which contradicted the students' rational or experiential expectations, such moments provoked interaction in the form of their comments; rational or experiential or other narratives. These moments were also not with the general hum but with intense dialogue. The general more unproductive-hums were generated and persisted when the discussions were diffuse or empirical such as when reading directly from the text, when explaining only the concepts from the text in a traditional way.

The experiences with the narrative approach thus gave a positive scope for teaching and learning in the class. The experiences also explicated the need for sensitivity and mindfulness of such narrative possibilities. There was a need to get the teachers exposed to the skills of identifying and using their own narratives and the student narratives: the skill of blending the narratives into the science lessons and to look at the narratives that are blended in the student discourses. This is something which needs to be

addressed based on the individual personality and style of the teachers. For example, Shanti Miss was successful with her own method of student group presentations. Bringing personal narratives of her own and of the students is important in her method that suits her own teaching style, but not the teaching styles of the other teachers.

A Teacher Reflection on Narrative Approach

The post-study interactions with the participating teachers mainly reflected a realistic understanding regarding the narrative approach. The teachers became aware of the potency of passionate interactions through the narrative approach. The narratives were provocative and promoted active learning. In both Vishwoniketan High School and Gandhi Adarsha High School the approach of the use of narratives in science at once inspired the teachers to use interactive teaching.

Interactive teaching was the fundamental upon which teachers and students narratives were brought into the classroom. As the teachers became more familiar with interactive teaching, the teachers and the students created plans for activities such as science activity days, story telling days, story and drawing displays, and science exhibitions. The teachers were interested to participate in publications and other activities. This approach brought a break in the monotony of traditional teaching and filled it with some new vigor. The approach gave a taste of better alternatives and hope that something new could be accomplished. In the last interview Shanti Miss and Kamala Miss almost spoke of the same concern:

Kamala: *Well you have been to Canada for so many years, you might have seen there or in other places, how narratives are being*

used to teach science. How did it go in the other places? What were their results?

Myself: *There is no place where such a method of using narratives has been used as a regular mode of teaching. In a few places there had been some efforts to study in this line. Such studies indicated that a storied approach for teaching is more effective than expository teaching. But these tests were in sociology rather than in science. A study on storied teaching of anthropology -- definition, methods and the tools of anthropology -- through the regular textbook and through the storied theme of an anthropologist working in Egypt showed that the storied approach was very much effective compared to the text book method.*

Shanti: *But there are many things that would be perhaps more effective if there were to be demonstrations in the class. For example, there is a saying that if a snake is squeezed by twisting by its head and tail, its feet will be seen. That could be done in the class.*

Kamala: *For example, the day before yesterday a grade 9 student had brought a discarded outer snake skin from Bagmati river side. He was playing with the skin in the class. I took that skin and talked about the snake feet in the class. I showed them that there was no place for feet but only the scaly parts. But there are lots of problems. For example, it is said that only a person with 32 virtues can see the snake feet, so how do we reach a conclusion in the class regarding seeing or not seeing snake feet?*

Shanti: *Also, many things cannot be shown in the class. For example, how do we show a live snake in the class? Can we? First of all there is the fear of the snake. Second, where do we find the snake and how do we bring it?*

The teacher responses indicate their inclination to take the challenge of the social narratives and the beliefs blended in it, but with many reservations. Perhaps there would have been no reference to such narratives

and the beliefs without an acceptance of the narratives as something important.

Kamala: *Well we cannot teach all the topics in the story form, but in those topics that we could, I think it would be better, won't it?*

Myself: *I mean on the one hand, these stories make teaching/learning interesting, on the other hand it is also useful in their day to day living.*

Kamala: *Perhaps this will also help them to think at their home and may be do some thing interesting in their home.*

Myself: *I think the crucial question is this: What do we teach science for? The science from the text takes us to a direction not in line with such stories and if we talk about the individual stories, it tends to take us to a direction that does not always fit with the textual science.*

Gauri joined the discussion: *The other thing is, do we only teach science in the school?*

Shanti added: *For example when we give lots of homework to the students, they protest that they need to do many other home works too.*
(Teacher meeting, November 2)

As the discussion shows, the narrative approach created enthusiasm among the teachers to engage in various educational activities. This also created a situation where teachers talked about different possibilities and limitations. It could be summed in their pointing at the need to address the current curriculum requirements, and the assurance that at that stage the narrative approach was just one possible beginning. In saying so there was both hope and an indication that our experience at this stage was not adequate to say at this stage that everything would go smoothly in the narrative approach. One thing that worried me was that it also indicated an

anticipation of the need for a type of proof that the approach would work in normal teaching situations. The student results in the examination, fortunately, did show that the students did better this year and in fact more so in the case of the students in the classes where narratives were rigorously used. A comparison of the test results is discussed in the Student's Response section below.

A Summary of this Section

Using narratives and stories to teach or learn science is not something teachers, students and the educators are used to. The concept is difficult to express in simple terms, particularly in a context where science teaching is done in textbook way -- reading, explaining of unfamiliar words and recalling of the definitions and formulas to test the learning. Stories are sometimes told in the class by some teachers, not in a way of formal teaching practice, but to break away from the regular class work: a respite while engaging the students in the class to fill in the vacancies of the absent teachers or to fill in the class that would not have taken place in normal sense. There was a sense of a lack of something concrete to teach through stories and narratives. This tradition was sensed in the stories and dialogues of the teachers, students, and the educators who contributed to this study.

It was with a hope of making a way to introduce the constructivist idea of beginning from the lived contexts of the students to achieve meaningful, interactive and cognitive teaching and learning of science in the Nepali schools where this study was conducted. In this study many limitations were anticipated beforehand and many more were realized later. There was no end to the further possibilities and the limitations, and those

which were more conspicuous have been discussed above. However, the spirit of the teachers to opt for a change from that limited teaching space available to them in that constrained school environment was something to be respected and kept alive. How do we do this remains an issue. Teaching with the aid of stories is interesting, interactive and helpful. But there are many things that needed to be learned before this could be realized as a natural way of teaching and learning.

The teachers were enthusiastic "to do something" to make science teaching and learning interesting and more relevant. Despite the limitations discussed above, their efforts brought some narratives in the class room discourses. This helped to generate experiences relevant to the narrative approach in science teaching. One important realization in this regard was that narratives had to have a spontaneous element to fit into the classroom discourses. For this, it has to come from real experiences. Constructed stories tended to be different from the real stories and they were received by the students as fabricated, not real enough to take for serious considerations.

There were numerous stories and narratives such as the stories of *Panch Tantra* that were not necessarily real experiences but were valued as interesting and useful. Some of these stories are normally introduced in social studies contents. Making it as a formal text content however removes the charm of the story telling and listening. My personal experience with which many other teachers seemed to agree, was that at moments when there was a need to memorize the details and principles to satisfy the examinations, the students became less spontaneous and more apprehensive. The stories certainly served to make science learning more fun and

motivating. But the complex issue is -- can fun and motivation be captured in a curriculum structure, will it be fun and motivation at all when it has to be used in the class routine? Does the fun and motivation emanate from the spontaneity of the teller or from the content and method of story telling?

Stories are often controversial, controversial in the sense that they bring in all the lay arguments and images that are conceptually not perfect and complete. The controversy makes it difficult to explain the stories in scientific way. Also, traditional curriculum practices require that science be taught in the textbook way. This, in a subtle way, inhibits storied teaching and learning.

Student Responses

In this section I will try to relate the effect of the narrative approach on grade 8 and grade 9 students in the various that participated in the study. It will turn out to be relatively easy to show that students enjoyed the story-based approach, and that this approach made possible a high degree of interaction between the teacher and the students. The study also showed that it was very difficult to evoke complete science-related stories from students, but fragments of stories from their reading, their home experience, or the myths they had been brought up with, did emerge once the students felt comfortable with the unusual amount of freedom in the science classes.

It also became clear that poems, drawings, or show-and-tell situations, in which students brought objects, plants or even animals from home, formed good triggers for evoking student stories or student interaction in the classroom.

Almost incidentally, since it did not form an explicit part of the objectives of the study, the narrative approach to science teaching evoked many alternate conceptions common to Nepalese junior high school students. In fact, many of these alternate conceptions have been shown in the literature to be common to young people in developed, as well as developing nations.

The study also showed that students, teachers and administrators show considerable skepticism with respect to the narrative approach to science teaching, and need to be shown that the narrative approach does not impact negatively on student grades on the traditional end-of-year examinations, as is shown in the present study.

This section of the thesis will indicate that, despite the many limitations of Nepalese science classrooms, such as the large number of students in each classroom and the lack of science equipment, that an interactive style of classroom teaching, such as the narrative approach, can be both enjoyable and effective.

Stories are Interesting

> Grade 8, A. August 23. I was about to start a topic in magnetism. I started the class with a story:
>
> *A long time ago when people did not know much about different materials and their properties, in Asia minor a shepherd boy was surprised and shocked when his shepherd pole stuck to the rock where he was standing. The rock was apparently pulling the metal tip of the pole towards it. This became a source of high curiosity, talk, and many stories. Clever people discovered that pieces of rock attracted or repelled each other. Because of this unusual behavior they named it the Kissing Stone.*

> Thus I interwove a story from what I have heard before, with the properties of magnets and then led the students into the topic of magnetism and the properties of magnetic objects. As soon as I began to do this, Pradeep, from the middle bench in the boys side, asked:
>
> *Well what happened to the story? Where is the story? Is it finished?*

The students in the class were always very attentive during the story telling, but then, after their expectation of being amused by interesting stories, needed more incentive to continue to be interested in the material to be taught. I tried to tone down the anticipation of a grand story to a realistic level by saying that it was not a grand fiction story, but a story based on fragments of facts and information designed to lead them into the important things they had to learn.

When they seemed disappointed, I told them some more stories about how magnetic compasses were devised by the ancient Chinese to navigate their way through the Gobi desert. How they made simple but reliable compasses, and kept them in wooden boxes that floated in vessels carried atop special white leading camels. After this, they did join in the classroom discussion on the properties of magnets, and related their own experiences with magnets. They related their experiences with magnets in pin holders, the magnets in bicycle dynamos, in speakers, bar magnets in the school etc. There was a personal tone, a sense of personal owning of the information they brought - being able to relate their own experiences created a passionate tone in their voices.

Whether it was about my story telling like the one above, or how my brother's drawing grew out of simple sketches of elliptical shapes

representing a meditative Buddha, viewed from above, or Yeshodham's telling of his experiences of diving in the pool, or Kamala's telling about snake legs, students were invariably drawn into a kind of curious listening. They always seemed to love listening to interesting stories and loved to tell what they knew, especially if that was something others did not know. Thus many student stories were generated -- the story of the snake's eyes, goat milk, the rainfall of fish, the rainbow, the curious deaths of crows , etc. Their narratives usually came in the form of fragments of what they had heard, read, seen, or believed, and were often presented in incomplete sentences. It was like a reaction to songs and music; a strong attraction to sing along and a desire to stand alone to sing but very, very hesitantly.

Those who could bring interesting stories quickly acquired the central spotlight. Others looked for more safe or secure spaces to reveal what they could. The telling and listening of the narratives were therefore not without some fear and suppression, but when the narratives were being floated around the class there was always great potential to engage the students in interactive discourse. For me, as a teacher, the challenge was to let the potential flow in the classroom dynamics in such a way that would benefit all the students and would tie the bits and pieces of the student narratives into a comprehensive story relevant to the study of science.

Drawing Figures and Making Stories

One of the experimental questions in the narrative approach was to see whether teacher prompting would evoke student narratives that blended into the science lessons in a natural way. So in the beginning specific requests were made to the students to write stories and narratives. But as discussed in

Chapter 4, the students found it rather difficult to write, or generate complete stories. I then investigated whether or not it was possible to find alternatives to story telling or writing.

For example, students were, at times, asked to draw things they thought were relevant to what we were learning in the class, to comment on their observations and on what was written in the text book, or to bring to school things they saw in their house or on their way to school, that they thought were relevant to a science class. Students responded eagerly to this by bringing plants, animals, making drawings, and telling stories. The students particularly enjoyed collecting plants, and interesting stones, and drawing animals, people, and places. But, as in story composition, limitations again arose when there was a need to make systematic and comprehensive presentations. The collections, presentations, and the drawings seemed influenced more by external outlines, colors and shapes, rather than a detailed representation of the scientific concepts they were studying. This could be due to lack of organizing or drawing skills and also due to a lack of reflection on the things collected, observed, drawn or written about. It became very clear from the drawings, stories and objects brought by students that 'observation' did not come naturally to them, but had to be learned and practiced. Sharing their stories and their thinking did help to construct a broader platform of shared experiences, such as Gadamar's (1975) 'fusion of horizons', but the teacher needs to plan carefully to use the stories to raise students to a higher level of observation and logical thinking.

Another important issue was the amount of individual attention and respect a teacher can give to students, in crowded classrooms sometimes

numbering up to 70 students. Although students clearly appreciated it when their stories and the figures were used to illustrate a scientific principle, it was not always possible to pay individual attention to each student's efforts in this way.

A number of times this limitation was addressed with the organization of grand ceremonial presentations such as art or story sessions at the Gandhi Adarsha school, in which grade 7 students had pasted their pictures on the walls of the classroom, and made short individual presentations. In Vishwoniketan High School, the students held a science fair, in which experiments, drawings of microscopic organisms, collections of plants, or other natural objects were presented to other classes and sometimes to parents. Such ceremonies were attractive to many of the students, but then only daring and well talented students occupied the prominent spaces in such approach. This effect was heightened in one case when the head of the school and the other teachers insisted the science exhibition should become a competition between students with prizes to go to the best presentations. In such cases the average students were often relegated to the position of listening and observing, or at the most asking questions of the students presenting the projects.

Bollnow (1989) pointed out a need for providing secure spaces for all children to grow, and to be able to find their own place in a wider world. Max van Manen (1991) explained the importance of tactfulness in teaching, of making each student feel safe, and respected in the classroom. In the Nepalese classrooms that were part of the study, there certainly was a challenge for the teachers to be tactful - to make the students feel secure in

bringing out their stories for sharing and for possible comments from the other students. There was a need both for a moment of being the proud possessor of a story and a moment for the acceptance of criticism. As mentioned in an earlier story, when Purna came to the blackboard to draw cows grazing in the backdrop of people and houses, the other students almost ridiculed his drawing, had not the teacher intervened to help him explain the meaning of what he drew. The teacher intervention helped Purna to react to the situation with an enticing laugh. The class also enjoyed the episode and everybody laughed off the situation. Only then did the other students appear to feel secure enough to show and to describe the various things that they had drawn.

The Non-Threatening Situations

The students in grade VII both in Gandhi Adarsha High School and Vishwoniketan High School soon became used to the relaxing atmosphere of the classes run with narrative approach. Their feeling of relaxed participation was evident from their behavior in the classroom:

> There is a hum of songs, spontaneous utterances, talking of personal interests and beliefs in the class. Lots of little group discussions and some students busy writing. Arun recited a satirical poem: What is important for whom -- *premi premika lai bhet thulo, bidyarthi lai path thulo, ...* (for lovers, meetings are great, for the students lessons are great . .) *But how is this related to science?*
>
> At this point there is an outburst of laughter.
>
> (Tape 1: classes in Gandhi Adarsha and Vishwoniketan)

The classroom atmosphere often appeared to be one of somewhat confused anticipation. Students were waiting to see what the next lesson would bring. Students clearly appreciated the teacher stories and even their own although they were always apprehensive about their presentations. In fact, they usually preferred it if the teacher would read their stories or poems. The most successful way of generating student narratives was to hold short informal conversations with the class. This strategy presented them with a more non-threatening situation in which they felt free to express their beliefs and concerns and at the same time were not required to bring them in a spectacular way that focused too much attention on them.

Another example of a non-threatening classroom situation in which the narrative approach evoked a wide ranging discussion occurred when Ritu brought a sketch of rhino.

> I showed the figure to the class to gain applause for Ritu. Amar pointed out the rhino's wrinkled thick skin.
>
> I started a popular joke: *How would the rhinoceros feel if you tickled it?*
>
> *Laugh Laugh.*

Amar added to the joke: *Sir, it will laugh for six months.*

Neelam asked innocently: *Why sir?* One of her neighbor started shaking hiding her face down on the bench with subdued giggle. Neelam's face brightened with a smile of understanding.

I threw out a question to turn the conversation towards the lesson: *Why are the rhinos becoming extinct?*

Reena: *Because of their horn, Sir.*

Myself: *Why is their horn so important?*

Reena: *Because the rhinoceros horn is used in radio, television, medicine etc.*

Myself: *I don't know if that is true, but the horns are used to make aphrodisiacs. It fetches lots of money and the poachers and the traders are very greedy and murderous.*

There was a moment of silence in the class, as the students thought about the situation.

Meera broke the silence: *But sir, don't they get punished for that?*

A lot of voices were added in support to show that the students felt that rhinoceroses, and other animals, should be protected from greedy human beings.

In a related episode this same class was once engaged in drawing and discussing pictures of different animals. Some of the students were proudly showing their pictures to the others while some were concentrating so hard on their drawing that they were singing or humming in the background. When the bell rang, the students would normally go to math class but the math teacher was absent that day. Rather than go outside to play the students asked to stay in the science class to continue their drawing and discussions. Many other students from outside came to the windows, curious to see why these students didn't want to go outside, and the students inside the class began to feel proud to be at the centre of interest, partly because of the interesting work they were doing.

Episodes like this clearly indicate that students recognized that a "narrative approach" to science teaching was very different from the traditional science teaching they had been used to. They also clearly enjoyed the approach, but sometimes showed their apprehension when they felt they were not studying for the examinations. It was as if they did not

recognize the teacher's efforts at tying the stories and other activities to the textbook topics. It almost seemed that the science that flowed from the stories, ceased to be "science" but became 'story' instead.

Interactive Narratives and Student Preconceptions

Story telling and listening helped to bring many student and teacher beliefs and even student preconceptions into discussion. In one class, grade VII A in Vishwoniketan, for example, the student narratives sporadically enlightened me about student preconceptions about stars, meteors, planets, and other topics of discussion. In this particular class Binita asked the question:

Sir, do stars drop?

Rather than answer her directly, I decided to probe a bit further.

Myself: *If the stars do drop on the ground, what will happen?*

Purna jumped in: *No, no, they burn in the atmosphere and only small parts fall on the ground.*

Amar added a bit more folklore: *Sir, the sun's bad rays Baijani (violet) absorbs the falling stars.*

This little episode reminded me of a similar story on falling stars, told by Brian Martin in Martin and Brouwer (1993), so I continued questioning.

Myself: *Do you know what a falling star actually is?*

Surprisingly Amar switched to a scientific explanation.

Amar: *A meteorite -- it is a form of stone, rock.*

Myself: *And where would these rocks come from?*

Amar answered: *From space, Sir. I have seen meteorites in Star Trek. Sir, I know why it falls.*

> This episode also demonstrates, in an interesting way, the finding that students find it relatively easy to divide their mental world into everyday knowledge, and classroom 'scientific' knowledge to be remembered for exams, but not integrated into every day knowledge. (Gilbert, Osborne, and Fensham, 1982, for example)
>
> Another alternate conception surfaced just minutes later. The students had been discussing what holds the meteorites up in space.

Dipak tried an anthropomorphic approach: *I know, I know! Those which become weak fall down.*

Another student shouted in a mocking voice: What *do you mean by weak? Going hungry and not being strong?*

> The students laughed but I persisted:

Myself: *But how do they stay in space? What holds them up?*

Amar again seemed to have the answer: *Gravitation holds the rock in space.*

Reena disagreed strongly, and responded with what has been shown (Berg and Brouwer, 1991; Ruggiero et al, 1985; Watts and Zylberstajn, 1982) to be an almost universal misconception:

> *But there is no gravitation in space!*

The conversation continued with a discussion of the nature of gravity, and whether or not there was gravity on other planets, but the bell rang and brought that day's discussion to an end. I could hear the students continuing the discussion in the hallway and felt rewarded. At least on this day a narrative, interactive approach to science teaching had taught me a lot about my students, and had allowed the students to learn a lot from each other and,

more important, had raised their level of enthusiasm about science a lot. (Personal journal, July 31)

Clearly not all the classes in which I tried the narrative approach were quite as rich and rewarding as this one. In most classes with such a narrative approach, e.g. the classes in which the snake's photographic eyes , the immortality of crows, the nature of the rainbow, the rain of fish, etc. took place, the discussions were more open and diverse, and the discussions did not last as long. However, even these classes were very interesting and enjoyable for both the teacher and the students. And in each of these classes, there were interesting challenges to address and it was possible to weave the discourses into thought-provoking science lessons for the students.

The Narrative Approach and Exam Anxiety

Although narrative discourses in the class were enjoyable and liked by all the students and teachers, there seemed to have been a strong feeling that the approach did not present serious learning activities. As discussed above in the teacher response section, the teachers were always worried that the course content in the text book might not be accomplished within the school session. One possible repercussion of such a situation would be student unrest at the time of exams and possible dismay of the headmaster over the situation. The students also showed similar anxiety regarding the science course not being taught in a traditional way. It felt similar to having a good meal that was forbidden during a medical therapy in Ayurvedic medicine, in that students desired and enjoyed the narrative discourses in science classes but were apprehensive that learning might have not taken place. They were worried about the examinations -- the final grades that could determine their

future. Thus in the class conducted with narrative approach, the students often reminded the teacher of the text and the course requirements:

> August, 23. As a follow-up to the last class discussion on rainbows, I told the class that we were going to further our discussion about rainbows starting from what they have written.

Reena, however, reminded me: *We have not read about indreni (the rainbow) yet!*

I responded a bit nonchalantly: *But that is okay. We will discuss it later, if you like.*

> I continued the lesson and asked them to present their assignments from last day - they had been asked to write a paragraph about their own beliefs about rainbows. However, none of them brought the assignment.

Ahsok said: *But, sir, this assignment is not in the textbook.*

(Tape 1)

Only a few of the students responded by writing about rainbows even after I insisted. Even then their paragraphs presented mainly the textbook version of rainbows and did not reflect the ideas they had talked about during the previous class, when they had come up with statements such as

> *It sucks up water from the rivers and the lakes to the sky and causes rain....It is a big bow of Indra and hence the name "Indra-Dhanu" .. ..*

Another explicit example of concern about the examinations was mentioned in Chapter 3 and 5. On October 31, after the two weeks long 'Dasainn' vacation, the final examination was just few weeks ahead, I was poised to engage the grade 8A students in an activity through drawings and

stories to relate animals and nature. Vivek, from the middle of the boys' section commented, hiding his face:

> *Sir, when are we going to study the course, the examination is near?*
>
> I was taken aback by the comment, I tried to hide my panic and explain how the course work was completed.

Myself: *You have read all the topics in the book yourselves; we have engaged in the discussions related to the topics; we have had some interesting activities that included demonstrations .. ..*

Arjun jumped into the conversations: *But sir, the questions in the examination will be from the book. You have not taught us the questions and how to answer them. If we don't know what to answer and how to answer we will fail the examination.*

I was confident that they would do better in the exam because I had conducted more tests in my class than in the traditional mode of teaching and that they had done very well in such class tests. Nevertheless, my panic was deep seated - what if the traditional test in the schools were such that the examination questions and the answers were dictated more by the textbook than by the actual teaching and learning strategies of the teachers and the students?

An evaluation of the final examination results shows that the students did well in the science examination. This, in a way, indicated that my panic and self-doubt were somewhat exaggerated. This also showed that the classes could be run in ways that differed from the traditional way -- in a more enjoyable and interesting way without upsetting the present system in a destructive way.

The following tables give some information regarding the trends of final examination results in the study schools and a comparison of the situation of half-yearly examinations and the final examinations:

Mid-session and Annual Examination Results
1990/91 - 1992/93
Vishwoniketan High School and Gandhi Adarsha High School

	1990/91		1991/92		1992/93	
	Mid sess.	Final	Mid sess	Final	Mid sess	Final
			Vishwoniketan Grade VII A			
Average	47.3	34.50	52.30	43.4	45.9	47.76
St. Dev.	14.00	12.22	13.55	15.52	16.30	16.06
No. Fail	11	34	4	29	24	12
Total No	73	76	65	64	70	69
Actual F		24		11		6
			Vishwoniketan Grade VII B			
Average	50.46	32.60	40.40	38.68	34.00	34.2
St. Dev.	19.30	12	7.05	11.92	11.35	12.10
No. Fail	7	37	2	15	17	16
Total No	77	76	70	70	58	59
Actual F		17		6		8
			Vishwoniketan Grade VIII A			
Average	36.15	44.8	38.00	48.92	32.5	54.64
St. Dev	19.00	16.22	14.44	15.02	16.15	16.96
No. Fail	38	55	28	30	44	12
Total No	77	77	60	60	80	80
Actual F		34		26		5
			Vishwoniketan Grade VIII B			
Average	44.25	34.07	38.40	32.48	34.2	42.84
St. Dev.	18.5	10.42	14.75	6.7	15.15	15.89
No. Fail	20	36	12	31	24	8
Total No	74	74	76	78	75	73
Actual F		11		9		0
			Gandhi Adarsha Grade VII			
Average	NA	49,91	NA	48.78	42.20	51.8
St. Dev		16.65		13.6	17.76	11.89
No. Fail		4		3	21	1
Total No		36		66	79	79
Actual F		4		3		1
			Gandhi Adarsha Grade VIII			
Average	NA	43.75	NA	31.75	33.18	33.28
St. Dev		12.81		10.59	12.67	12.60
No. Fail		5		14	34	31
Total No		58		48	69	69
Actual F		NA		NA		NA

The results show a remarkable gain in marks obtained by the students at the 1992/93 final examination session compared to its mid session (half

yearly) results. For example in Vishwoniketan grade 7A, the difference between the class average of annual exam from the mid session average in 1991, 1992 and 1993 are -12.8, -8.9 and +1.86 respectively. In grade 8A of this school the differences for the three years are +8.65, +10.92 and 22.14 respectively. This is almost a complete reversal of the general trend in the preceding years in which more students failed in the final examinations compared to the half-yearly exams. The study intervention was during the period between the half yearly exams and the final exams. Although the difference in the examination results could superficially be taken as a marked effect brought about by the study intervention, a number of factors might well have influenced the results:

1. The school examination practices at grade 7 and 8 level are not based on standardized tests and there were no defined regulations to govern the standards. This is reflected in the large fluctuation in the marks obtained across the individual students and across the averages at different time.

2. The half-yearly examinations marks were weighted 20% of the final total and, therefore, the marks and number of failures in the final examination does not necessarily represent the final total of failures in the course.

3. The school records are not well maintained, and there could easily be variations in the previous years' grades that reflect some local 'reinterpretations' of science grades that might well have been forced to be in line with the grades in other subjects.

4. It was noted also, during the marks collection, that there was a general hesitation to provide the marked copies of the exams. The exam copies were obtained on the condition of not tallying with the posted marks or to reveal the marks in the copies that could identify the students involved.

In addition to these points there is also the fact that this year the researcher's presence created many activities in the school in the form of science exhibitions, in the form of class activities, and demonstrations, and in the form of writing of narratives and short tests in the classrooms.

Despite the limitations of the use of the exam marks to support the narrative approach, the situation indicated that introducing a new approach did not hamper the student achievements in traditional exams.

In general, students liked the narrative approach, although they preferred stories which contained controversial happenings such as fish falling from the sky, milk-giving male goats, mythical rainbows, unexpected behavior of snakes, multiple-headed animals, and so on. Both in Vishwoniketan and Gandhi Adarsha High Schools, students often referred to "Yuva Manch", a local monthly journal for young people. It often discussed topics like those mentioned above. The students enjoyed this journal so much, that they could sometimes be caught reading Yuva Manch in the classroom while the teacher was teaching different things. In one of my classes I used a photocopy from the Yuva Manch magazine to teach about the stars and the Galaxy. The students were amazed that Yuva Manch could be brought in the classroom discussion, and it motivated them to read the

textbook also and they did some good writing about the galaxy and the star constellations.

Summary of this Section

Students enjoyed the stories in science class. The use of narratives in the class created a non-threatening and enjoyable atmosphere in the science class. The narrative approach was highly interactive and induced several student activities such as exhibitions, story sessions, and bringing of the plants and animals and other materials from home. It also turned out to be a valuable way for a teacher to become familiar with the alternative conceptions that students had about the many scientific concepts in the grade 7 and 8 courses. And, despite some considerable initial anxiety of both the teachers and the students, it turned out a successful approach from the traditional examination point of view as well.

School Administrator's Response

In Nepal a headmaster's day in a public school would be both physically and mentally exhausting -- supervising the school record keeping, planning strategy for the upbringing of the school, facing numerous student/parent related issues, supervision of the classes for their smooth running, regulating routines and immediate management of the classes left vacant due to absent teachers, and also taking a regular teaching responsibility. The limitations of the physical facilities and resources such as unfinished classrooms and inadequate basic furniture, lack of resources to even maintain them properly, large student numbers, and the population of

the society that still remains mostly unfamiliar about school education functioning, add to the problem of administering a school in Nepal. Given the contexts, it was understandable that the headmasters were enthusiastic but with some apprehension regarding the narrative approach at the beginning. One reason for their enthusiasm stemmed from the hope that the approach calls for an action research mode of implementation that would help create a congenial atmosphere of school as a family sharing responsibilities and outcomes. The other reason stemmed from the possibility of making classroom teaching interesting, useful and effective in the social, cultural and environmental contexts. The apprehension on the other hand was an outcome of the current paradigmatic standards such as the textbook-based examination and the evaluation of schools based on their performance in the centralized national examinations at the high school exit level (School Leaving Certificate, SLC, examination). Another tension to the public school administrators comes from private schools opened with a profit motive. These private schools offer intensive English courses and rigorously prepare students for the examinations reaping good success and therefore displaying a higher status. These schools could charge exorbitant fees and could pay their teachers well. Public schools cannot do that because of the government regulations and also because of the public pressure. Where would a narrative approach stand for the headmasters in the contexts of their inner aspirations and the external conditions that limited the administrative running of a school? The following is a discussion with this question in view. The discussion is based on the interviews with the headmasters and also on the personal observations and journal.

The headmaster in Gandhi Adarsha was interested in the social aspect of the narrative approach. He was especially interested in developing a community circle to help improve the school activities. This school in the semi-rural Kathmandu has been for a long time struggling to have an honorable success in the SLC examinations. The headmaster as well as the other teachers in the school were aware that, due to the simple agrarian village life from where most of the students came, the school needed to do something very different to achieve that success. During the research period it was observed that the school was virtually shut down whenever it was a local festival day or even few days before and after because fewer students came to the school. During the school day, the students preferred to engage in different games with full energy, but in the classes they were less interested. The headmaster had told me:

> *You ask to participate in the games and they jump to it. They are successful in matches and some of the students have become leading players in volley ball and soccer at the national level. But you ask them to be serious in their study, they are repulsed from you. There must be a way to help them through school to make them feel good in the positive things they do. But to succeed educationally they must also do well in the examinations.* (Journal, August 27)

How to make the students and the school community engage in serious teaching and learning activities? How to make them exercise for the examinations? Or how to bring other school activities in a more disciplined way so that these activities could be made congenial to teaching and learning? I kept these questions in mind while engaging in the narrative teaching, for the approach certainly has potential to utilize the spirit of

playfulness and the energy of the students. These were used to reorganize the school science room and to conduct interesting science activities such as story telling, environmental drawing, and collection and exhibition of animals and plants. The head master was happy the way students and the science teachers worked to reorganize the science room and to conduct the science activities. He had asked me if I could train the other subject teachers as well to work in similar way. Indeed, there seemed to be a lot of scope to introduce collaborative action research and the narrative approach in teacher training.

The concerns and interests of the headmaster in Vishwoniketan was slightly different. Vishwoniketan being a school in the city downtown, the students come from many different backgrounds. Here is an instance of a conversation based on his observation of the narrative approach:

> August 29, Sunday. Vishwoniketan High School. On this Sunday, Mr. Veda Nat Regime a senior professor in Tribhuvan University, came with me to visit Vishwoniketan High School. He was interested in observing how I carried out my narrative approach to science teaching in a classroom situation. He was a language teacher, and had taught me English and Newari in Amrit Science College. He was also a friend of the Headmaster of the school Mr. Gambhir Man. Mr. Gambhir Man was also interested in observing my class and this motivated him to actually do so.
>
> The students had brought drawings to the classroom that they had taken home to finish from the last class. In the last class, I had asked them to draw any picture they liked, provided it was related to the science topic on Plants and Animals that we had been studying during the past few lessons. Some of the pictures were very good, and were indeed related to the topic. For example, the anatomical picture of a frog and the detailed picture of a butterfly.

The class, as well as I, knew who had drawn these pictures -- Niran Shahi and Suren Shahi. These are the two brothers whose parents had a painting shop and sometimes they would have to work in the workshop too. Unfortunately, these boys were not very good in the examinations. Niran was repeating the grade he was in because of his poor performance in the class in the past year. I asked them to stand up so as to introduce them to Mr. Gambhir Man and Mr. Regmi.

After this we went on to study the parts of the flowers and their functions. So, in the class I asked the students to draw the parts of the flower and label them and describe their functions. This gave me time to move around to the last bench where Mr. Gambhir Man and Professor Regmi were still busy looking at the pictures and admiring them.

Some of the students who were quick to do the work started calling me to show the pictures and the labeling. Others were busy shuffling the book for the information, and others were still refining their drawings. Mr. Regmi asked me if he could have few minutes to talk to the students. He seemed excited with the classroom environment - the disciplined and well behaved manner of the students, their interesting activities that were producing colorful and creative pictures, and their subdued clatter and laughter, and giggles.

Mr. Regmi explained to the class how the things they were learning in science could also be found in language class. The kids were all receptive and happy. Afterwards, Mr. Gambhir Man told the students that he had enjoyed their pictures and the interesting class. He also reminded the students to behave like this all through their student life. As we left for Mr. Gambhir Man's office, Mr. Regmi was impatient to start the conversation about the classroom experience. It had been a very long time since he had taught in a lower grade class like this one.

Mr. Regmi exclaimed: *It is interesting to be with children; it is like heavenly bliss, their laughter, innocence, and unpolished utterances!*

Mr. Gambhir Man agreed adding that in these times teachers were not giving enough attention to these aspects of learning: *They are simply not genuinely interested in teaching the students, in developing their potentiality, and in applauding their talents. What they are too interested in is having them do what they are told to do -- finish the course somehow and sit still.*

I prompted Mr. Gambhir Man to indicate what aspects of the class he liked and what he thought needed to be improved. His first request was a need to bring that congenial environment to teach science to the students in such a way that they would be successful in the examinations. He was of the opinion that "science is science" that needs to be seriously learned apart from the contexts and the congeniality. His satisfaction was with the classroom environment -- the way students were able to engage in constructive learning while enjoying the freedom of childlike talk, giggles, and mercurial behavior. The way children brought their own beliefs and understanding in their personal narratives was something that was not to be found in traditional class. Gambhir Man then told his own experience of how as a child he wanted to do experiments and tell his own viewpoints but never had a chance to do so in a class or anywhere else. His talk then focused to his teaching experiences as an English language teacher which Mr. Regmi reciprocated. I was happy listening to their narratives as language teachers reflecting on the success of the narratives triggered by the student drawings in the science classroom they had observed.

As is evident from the above discussion, the foremost importance regarding science teaching or any other subject that the headmasters considered was the dedication of the teachers towards maintaining good discipline in the classroom, in completing course work and in achieving

good results in the examinations. Another concern was that most of the science teachers had another regular job such as private tuition and/or teaching in other (privately owned) schools or university campuses. Their professional energy and efforts were being shared with the responsibilities other than that of the school. It visibly caused constraints in their class routine and a concern for the headmasters who felt that the school environment has continuously been deteriorating in the recent trend. This concern was reflected more in a conversation with Mr. Gambhir Man at another time:

> After answering the third telephone ring in this brief moment of waiting in his room to talk about the narrative approach, the headmaster in Vishwoniketan High School received two more people and then settled to respond to this my question: *How do you feel about the narrative approach being tried in the school?*

Mr. Gambhir Man: *Well, it seems interesting and useful but whether it will be a good approach to continue will depend on the teachers. I mean, it is not only a method being tried in the school, but the whole of the success of the school depends on whether or not the teachers are dedicated. My feeling is there has been some downward trend, and it is reflected in our achievements in SLC examinations: In 2046 BS, 75% of the students passed the exam, 40% in first division; previous year the pass percentage was 91%, 68% passed in first division; last year just 35% passed with fewer in first division.*

> Mr. Gambhir man's concern about SLC examination is obvious, it is virtually the sole measure of the status of a school in Nepal. Lower pass rate mean loss of student enrollment and eventual degeneration of the economic and social standing of the school. I tried to moderate the concern by indicating the possibility that the change in the school background might be due to the present trend that parents now tend to put their children in the private schools.

The conversation was momentarily broken as a parent and a student entered the room to talk about an exam that the child had missed. The parent was worried that his child might be stuck in the same grade for the next year.

After the parents left, the headmaster pointed out the problem.

Mr. Gambhir Man: *Parents are not bothered to enroll their children at a lower grade in a private school and to pay higher fees. But in a public school, they put on pressure to send up their children to higher grade even when they are not doing well. And they are not happy to pay even the insignificant fees. The teachers also don't work hard in general schools. There are teachers in this school who also work in private schools. Their attitude in those private schools and here are different. They are made to work very hard there, and they don't complain. But here they are reluctant to work harder.*

I tried to bring the conversation back to the narrative approach and cooperative teaching through action research.

Myself: *Given the situation, what do you think should be done to alleviate the problems? What do you think about the narrative approach through a cooperative strategy?*

Mr. Gambhir Man answered: *We must try hard to keep our prestige as a good school. This could be done only by preserving a sense of belongingness to the school. The first step required for this is to have effective teachers; good and competent teachers. I would be happy if such method could produce motivated teacher, create a situation of good teaching, effective teaching, good learning.*

Mr. Gambhir Man continued: *I think all these have to go against the current circumstances of evaluation of schools and the students. What kind of school evaluation are the people and the school authorities carrying out? What kind of behavioral change in students are they expecting? These issues are grossly overlooked. Most Private schools just teach how to answer the exam questions and they are emphasizing more on English teaching. These schools because they score better in the present examination system, they are looked at as good schools.*

What is the philosophy of education? What kind of citizen are we preparing? 10 years before the situation was different, our aspirations were different, so was our status different.

Again the phone rang and the discussion was interrupted. It was another phone call of a student asking about the exam results and asking to see a teacher. The conversation, the interruptions by the phone calls and the visitors mostly talking about the examinations and the results made me feel the depth of the desperation that the school administrators have to face meeting the contextual challenges. I tried to give some positive twist.

Myself: *May be we need an action research situation where all of us involved in running this school can share the concerns and talk about ways to get out of this situation, I am confident that this narrative approach could be one such step in this regard.*

Mr. Gambhir Man: *I hope so. Let us see.*

Although the headmasters were concerned with the classroom teaching, their other responsibilities usually kept them quite busy. Nevertheless, there was a need to reflect on the whole situation. Most of the time the headmasters were not available to join in our teacher meetings and the seminar meetings. The divided responsibilities often kept them from such teacher meetings. Incidentally, both the headmasters were language teachers and so they also thought it not proper or contextual for them to join the science teacher meetings. Even an assistant headmaster Mr. Khayeguli who had been a science teacher, thought it not necessary to join the meetings now that he was more involved in the school administration than in teaching. With much persuasion, Khayeguli once participated but never spoke a word in the meeting. The silence seemed to project indifference towards the science teachers' issues.

Such backing off from the concerns of the day-to-day teaching in the school has developed a wall between the teachers and the headmasters. Headmasters are often inaccessible to the teachers for the purpose of teaching practice discussion. It was up to the teachers to try different approaches to teaching in the classrooms, so long as their new activities did not disrupt or degenerate the current state of stability. Better yet, if the students were more satisfied and the courses were finished on time and the students would do well in the examinations. These are genuine concerns given the administrative responsibilities but then the teachers were expected to be innovative at their own risk without the sharing of the risks by the headmasters.

In Nepal, although many indigenous traditional social responsibilities are shared by the cooperating families, the modes of formal official relations follow a hierarchy of stand-alone responsibilities and call for hierarchical respects. An action research approach to innovation in the classroom, such as practiced in the present study, promises to help bring a more cooperative, sharing spirit to the various schools.

Summary of This Section

Headmasters in Nepali schools live in a tension between internal aspirations of making school education interesting, effective and socially relevant, and the outer need to address the concerns of external examinations, the wave of new competition brought by private academic schools, and a largely traditional population that is not yet open to modern school education. The traditional hierarchical and compartmentalized ways of defining responsibilities also limit their intervention to make school

activities more dynamic. They felt that the narrative approach to science teaching, brought in an action research context, could be a potential avenue to break out from those limitations.

Chapter VII

REFLECTIONS ON THE RESEARCH

School education has come like a new social paradigm in the countries like Nepal and has been in conflict with the sociocultural and economic environments. In this paradigm, modern development-oriented curriculum is set by the central authority and the school science curriculum is loaded with objectives of scientific skills and knowledge. However, due to the lack of facilities and modern scientific activities a school is bound to address the science curriculum in the only way it could: to meet the centrally set curriculum standards through nationally standardized student examinations. The other developments also tended to flow in this direction: Textbooks are centrally produced and distributed so that they address the need of such examinations and the examinations are based only on such textbooks. Thus the tacit emphasis of this paradigmatic school education has become to train students to succeed in such examinations. Success in the examination is rewarded with the chances of better economical and social positions. Modern houses, industries, laboratories, libraries, technologies, etc., are the outcomes of this education which only the successful students will attain. In contrast the majority of the people in countries like Nepal have remained cut off from the rewards of a modern school education (literacy rate: 35%, CBS, 1992) and are labeled illiterate, uneducated, and therefore unfit to stake a claim in the modern social positions.

In countries like Nepal practical knowledge and social stories blend with mythical and religious philosophies. Collections of such knowledge

and stories along with the philosophical treatises on various aspects such as health, math for astrology and general arithmetic uses, natural resources, social affairs, art and music, were the basis of traditional education. Apprenticeship, monastic education, or clandestinely organized professional schools were the only forms of formal schooling. Such education had in the past led to periodical explosions of architecture, arts, music, and numerous social celebrations that are celebrated even today. In other word, such social education constituted a social paradigm of such countries in the past. The traditions and the monuments of the pasts still exist in Nepal in remnant forms providing somewhat disjointed living experiences under the past paradigm.

As mentioned in my personal reflections in Chapter 1, pp. 11 - 19, the situation creates a dilemma for the students: A need to be in two different worlds -- the world of modern education and the world of social traditions inherited from the past. Often, in modern education students prepare for the examinations to pass onto higher grade levels, while in the society the social customs and traditions are observed to meet the ritual requirements. In school science education, students are required to remember what they recite from the texts whether or not they understand what they have had to memorize. The social knowledge, on the other hand, encompasses beliefs which have no logical rational connection with the current knowledge system. It would not make rational sense if one believes that serpents should not be harmed because they are the guardians of water and wealth and the sentient beings of the underworld, or that frogs are friendly demons who would save the rice field from harmful beings if respectfully treated, or that

all living beings are mystical in origin and nature, who are in their present form only because of their deeds in the past life and therefore deserve equal status to us who are in human forms, etc. Some socially critical literature (e.g., Bajaj, 1988; Nandy, 1988; Vishwonathan, 1988) has pointed to a lack of constructive and interactive approaches in modern science education to reflect on the wisdom behind such social narratives.

In Chapter 1, many problems related to modern school education in general and science education in particular in countries like Nepal were discussed. There it was also argued for a need to make science education interact with social knowledge and other experiential knowledge of the students in a constructive way. This study was proposed with the belief that school should play a mediating role to make the social sphere interact with the modern sphere of science -- school science education should instill among the students a positive and creative skill of constructing new possibilities where they would have both an understanding of social wisdom accumulated through generations, and an appreciation of the knowledge of science as the outcome of hard work and perseverance of many scientists through many generations. Such possibilities would give a sense of joy and comfort in the modern technological attributes of science as well as make our life existentially more meaningful by contributing towards achieving the mythical heaven that is to be encountered so often in the cultural stories. For this to occur the first need is to bring together the two spheres, the sphere of cultural knowledge and of science, through school education. Thus the central research question was: **How effective is the narrative approach to**

science education in creating bridges between school science and the student's lived-in contexts?

The narrative approach was chosen as a means of bridge building in this study. The choice came from the argumentative and philosophical discourses discussed in Chapter 2. More scientists and philosophers are now rediscovering the strength of narratives as a means of reaching the inner consciousness of people to understand their *raga* (the guiding humors, such as beliefs and passions) and to help reconstitute them in a bigger horizon.

The choice of the narrative approach was also based on an understanding that much social knowledge and wisdom is often embedded in the social fables, riddles, and other narratives. Also such social narratives relate the problems and possibilities of local environments, such as associations of star positions to seasons, the clouds and the weather, the plants and their attributes, the insects in the field, the memory and specialized skills of animals, the variety of the plants that help each other when grown together, the way of finding a natural source of water, the way of cleaning wells. It was expected that the student narratives would bring into the open many such social beliefs.

The contexts of the study in the actual school and social setting -- the limitations and the positive aspects of social narratives, the tradition, culture, and local economy were discussed in Chapter 3. There it was indicated how the contexts limit the scope of modern school education and process of overcoming such limitations through narrative approach were suggested.

The discussions in Chapter 4 and 5 and 6 illustrated the feasibility of using narratives as a means of bridging the student's social contexts to school

science. This provided a positive answer to the central question: The narrative approach to science education was shown to be an effective means of bridging students' lived-in contexts with science. However in making such statement, several conditions of the situations were also elaborated in these chapters. The specific questions of this research were designed to critically examine such conditions as well as the situations. In the following sections I intend to elaborate on these questions.

Constructing Narratives that Resonated with the Students' Experiences

One of the most important questions of the study was: **Will it be possible to construct narratives that resonate with students' experiences, and help to bring out students' narratives concerning science?** The initial approach regarding this question, before going to the schools in Nepal for the field study, was to collect and or construct exemplar narratives to teach. This was an intuitive approach that also reflected the similar concerns of the teachers. As indicated in Chapter 5, the teachers often did feel a need for ready made narratives that could be used in the classroom. However, the school experiences showed that such narratives were of little use. Such narratives, constructed to relate to science topics such as the story of the magnet (p. 200), the story of Archimedes' discovery (p.110), the story of perception and drawing, were received by the students with interest and enthusiasm, but these stories did not trigger their narratives. Rather, small fragmented conversations that included social beliefs were very effective in letting out the student narratives. Thus, more student narratives were generated when the classroom discussions were opened with the narrative fragments like -- snakes can retain the visual memory of those who harm

them, or snakes have legs visible only to those who are perfect with 32 virtues, or rainbows suck up water to the sky to make rain, or crows don't die naturally, etc. The passions with which some students in Vishwoniketan invited me to go and see "Boxi Daha," or the seriousness of Purna who brought the news clip and Yuva Manch to verify fish falling with rain, were notable.

The other important aspect of generating student narratives was a need to address them from a position which was appropriate to the students' level of discourse -- a need to suppress hierarchical relationship between the teacher and the students and for the teacher to talk like the students do, and be their friend. In the traditional school relationship in Nepal, a teacher is supposed to assume a higher position of commanding authority over what is being discussed in the class room and dictating what is expected from the students. In a traditional classroom, students often waited passively for the teacher instruction, for the lecture. Thus at the beginning, when I as a teacher told the class that I wanted to discuss stories related to science, the students' reaction was to wait for me to tell them stories. There was a feeling that teachers have the correct answers and correct stories. Thus the initial reaction to the narrative approach in the class was to anticipate teacher instruction and to follow the instructions without self-initiated responses. This situation was overcome by opening up with small fragmented narratives like the ones the students themselves were able to produce. For example, when the students asked whether the snakes are capable of registering the image of the people, my reaction was to tell them that it is said so and that I have heard about it. However, at the same time I also indicated that some

scientists doing research on snakes had indicated that snakes in general have a short memory. Similarly, when the students brought the issue of fish falling with rain, I told them a legend of how a fish falling from the sky once upon a time had supposedly saved the country from drought. The fish with that divine power was then installed with respect as a godly spirit in the Ason square. I also provided them various possibilities, how fish might have been captured in rainstorms lifting and dragging a portion of water from the nearest sea to Nepal where the storm dropped their rain against the mountains making the fishes drop along with the water. I made conscious efforts to bring related science information with the suffices "it is said", "I think", and "what do you think?" Sharing of their laughter, smiles, and gestures and showing friendly concerns for their feelings and beliefs were found to be crucial in making them talk freely.

Self-expression through drawings and their interpretations by the students with the assistance of the teacher was found to be another way to generate student narratives about their lived social and physical environment. Such sessions were held both in Vishwoniketan and Gandhi Adarsha, and were quite successful. In Gandhi Adarsha students participated freely in generating drawings depicting the environment, various animals and even people and buildings. These pictures were generated as a result of the classroom instruction on the environment: how different animals and the things in the environment interact with each other. They also generated stories about good and bad influences on the environment. The stories tied up family, community relations and living style with the theme of the environment.

Science activities and student initiated science projects were also some of the most potent moments for generating student narratives. During such activities students' ideas, prior conceptions, and skills were reflected in their conceptions, and approaches, as well as in the execution of the activities. In one such example, Ananta, a student from grade 8A, Vishwoniketan, proposed to make a battery using potato slices. His project was to make a series of sandwiches consisting of thin slices of potato between zinc and copper plates. His explanation which tied the science projects to things he had experienced outside of school, was--

> A potato contains a special chemical that is good for making an electric battery. It was not even known to many scientists what it is. I have seen a demonstration in a TV magic show.
>
> Myself:
>
> *Why not try other vegetables such as tomato, radish, squash?*

His enthusiasm was unlimited but he was of the firm belief that the potato has qualities that the other vegetables do not have. I tried to amend his project by including various other vegetables as the electrolyte, but he insisted on working only with potato for he was not so sure about the others. He managed to run a digital watch with the potato battery.

Niran, with the professional artist family background had a project of constructing a butterfly. He had little explanation for the butterfly species, or its color and size and their distribution, but he made such a beautiful and lifelike model that it attracted the crowd. I wondered how come he could give such a detailed touch to the butterfly and yet had little explanation for what he did. Obviously, Polanyi (1968) must have been influenced by such

potentiality in indicating that people often know much more than they could express verbally. This reminded me of an issue: How to balance the verbal capability with the development and enhancement of the students' creativity and knowledge. By making their talent come out along with their explicated narratives, the narrative approach to science education certainly promises to be a better approach to address this issue.

Connecting Science and Social Contexts through Narratives

The need to connect science to the social contexts of the students was one of the fundamental concerns of this study. As discussed earlier in Chapters 1 and 2, much of our science education related problems are due to the failure of connecting science education to our social contexts. Traditional science education did not generate the knowledge and skills that could help people address day-to-day living in a scientific way. For the students, school science education was more of a subject requirement to pass in order to get to a higher grade level rather than an interesting and useful subject area. It was, therefore, a subject of debate in Nepal whether to include science as a compulsory subject or to make it optional at the high school grade level. What was not seen in these projections of the issues is the potentiality of science as an interesting way of looking around the environment to understand it better and to help situate people in their environment in a better way. It is with this belief that this study was designed to find a way to link science education to the social contexts of the students and the teachers. The narrative approach was argumentatively found suitable to bring such linkage in a better way and therefore chosen for this study. Thus the second research question of this study included following questions:

Will such narratives or student narratives develop a meaningful relationship between school science and the lived world of students and teachers? In other words can a narrative approach address the research question of bringing in social and environmental contexts into the science classroom?

As discussed in Chapters 4-6, the student narratives brought many social beliefs and their other beliefs constructed to the classroom discussions. In doing so in a science class, there was a scientific inquiry, and interpretations and extrapolations from the cultural beliefs which generated vigorous interactions. Thus the interactions created learning questions, like the following, which linked the narratives directly to the science topic we were studying at the time:

> It is said that snakes are capable of capturing the images of people: Is photographic film made out of snake's eyes?
>
> If there is no fish in the sky how come they sometimes fall down with rain? Is it possible that rainbows suck water up to the sky to make rain?
>
> Where would one fall to if we fall down from the earth?
>
> Is it true that the crows do not die a natural death because they have tasted the elixir of immortality?
>
> Do snakes have invisible legs?

The questions may seem very naive from a paradigmatic scientific point of view, but from the premise of a child brought up in an environment of a paradigm of knowledge that deals with the world with a perspective that connects events and nature to mystical existence and that calls for a

submission to the wonders that are beyond human grasp, there would be no conclusive answers to these questions. For example, how would one know how long a snake can remember for sure? Is our perception of a snake's memory equally valid from a snake's perspective? Besides, there is no way one could conclusively say that there is no such person with perfect 32 virtues to be able to see the snake's legs. These situations provide an opportunity for the students to feel the inadequacy of traditional knowledge as well as the limitations of the scientific knowledge. In other word, this might help them accept the imperfectness of the process of knowledge-making and knowledge sources, and give them opportunities to reflect on their own knowledge-making. I think this is an important part of learning that bestows due respect to the knowledge generated in the past and allows the students to appreciate and use the present knowledge of science, and also contribute to generating new knowledge.

It could be concluded that the narrative approach in the present study did help to enhance a social connection to school science in a constructive way; in a way of becoming aware of what knowledge students possessed from society and had guided them almost subconsciously in making their perceptions of the world, and then reflecting on these perceptions from a different way, in the way of school science. This helped the children to a better appreciation of science education as an interesting subject, which relates to, but does not necessarily threaten, their traditional knowledge and ways of learning.

The narrative approach while addressing the social experiential dimension of the students' learning also addressed the paradigmatic side of

science. In the class we talked about the rainbows sucking up water and we also talked about raindrops dispersing sunlight to give a spectrum. Some of the students had come up with the examples of demonstrating the phenomena of rainbows.

Purna had suggested: You *fill up your mouth with water and then spray them up with your back to the sun, you can see the rainbow-like picture.*

Reena had recalled: *Sir I have seen rainbow-like colors in the fountain in Balaju Park.*

Similar science concepts in their textbooks were discussed and used to explain the falling of the fish with rain; lightning and their effect; plants, animals, and their ecological relations, etc. The notable thing in this regard is that students learned paradigmatic science without having to use the formal language of the text book. Our classes were mostly fun with talk that suited their childlike age and yet the discussions did lead the students to learn science as well, but almost incidentally, not in a text recitation mode. In fact the student reaction showed how the students were surprised that they were not "taught" science in the traditional sense. And yet they learned science in a way that seemed to be much more natural and enjoyable.

Narratives and the Science Content Requirements

One problem of traditional school science that has challenged many of the efforts to make science education more interesting and of immediate use to the students in their daily life is the way it has been designed and executed. The course content as laid out in the school has always been an important requirement to fulfill: To go through the content and help students

remember it so that they could regurgitate it during the examination. Activities, whether hands-on type science activities, project work, and other individually creative activities in the school were deemed to take such time and effort that would not allow enough time to recite the texts by the teacher in the class. This tradition was the major motivation for this study and it was anticipated that the skills required by the students to face the conventional examinations would evolve from their class discussion. Thus, the third research question of this study was: **Does the narrative approach also contribute towards achievement of the content requirements of school science?**

During the study, because there was much more interaction with the students than in traditional classroom instruction, it was possible to talk about the contents of the texts rather than to memorize the texts. Also, this helped to invite the students to read the textbook interactively to pick the topic of their interest and to engage them in question-answer type exercises that related to the class discussions. The students also enjoyed the tests conducted in the classroom, not so much for the preparation for the final examinations but to enhance their learning from the texts and the class discussions. Such tests were often open-book tests and allowed them to become very familiar with their textbook. One prominent reaction to such tests was to laugh them off -- "What kind of test is this, you can look at the book and even copy?" What made the researcher satisfied is the way the students were enabled through the approach to look for information in this book in an interactive way, and weaving the bits and pieces of information from the book with the students' narratives.

Simple, almost effortless learning activities that evolved through the approach made the students feel that they were not taught science. This gave them an initial anxiety -- the anxiety of not accomplishing the course requirement in preparation for the examination. As was discussed earlier, the grade 8 A students in Vishwoniketan were anxious in thinking that they had not learned science content at all. Irrespective of such reactions, their results in their final examinations showed that they did well even in the conventional tests (Chapter 5, pp. 215-218). The examination results, the student participation in classroom discussions, and the student participation in other science education activities all indicated that the narrative approach generated enthusiasm among the students to learn science in a way that related to their cultural experiences and yet made them capable of addressing traditional school examination requirements. This is an important aspect in bringing changes in the current practices in school education, without time-consuming or expensive disruptions.

As discussed in Chapter 5, Head Master's Response Section (p. 220), one of the important requirements for school education is to maintain a harmony with the expectations and aspirations of the parents and society at large, and at present the successful performance of the students in the tests with good scores is the most important way of maintaining such harmony. Because of the way the educational system has been set up in Nepal the traditional examination will remain for some time until a new method is gradually brought in to take its place. Consequently the exams will continue to constrain the methods of teaching. The narrative approach seems

promising in making possible a gradual, almost evolutionary change in the methods of science teaching.

Student Preconceptions and the Narrative Approach

As is evident from many student stories generated in the narrative approach, the students' stories also came richly embedded with their beliefs and preconceptions. Although this study was not intended to investigate their preconceptions in detail, it was surprising to see how frequently the student narratives brought the student preconceptions into the discourse. Also, from the way their preconceptions were embedded in the narrative interactions, it became evident that the students tended to separate their everyday knowledge, for use in everyday affairs, while for the classroom and the examinations they tried to work with the textbook scientific conceptions. The other interesting aspect of student preconceptions was the universality of the preconceptions regarding phenomena like gravity and space (p.208). The discussions that started with students' preconceptions, which were often based on a partial understanding of science or myth, also led to passionate discussions and lasted longer than the other types of discourse.

The Importance of Action Research in this Study

Carson (1991) explains about a need to personally mediate theory and practice in teacher education through personal subjectivity and critical reflection. Through such subjectivity and critical reflection a situation emerges where the relations with the fellow teachers are deepened through listening and telling of personal narratives. Creating such situations are especially important in school contexts like those in Nepal. As is evident

from the school situations discussed, it was necessary all through the study period to be sensitive to the circumstances, understand the potentialities and limitations of the participating teachers as well as let them know my own potentiality and limitations. In Nepalese school contexts, which still work very much on hierarchical lines, it was difficult to get to a horizontal relationship for interaction regarding formal teaching and learning. It was only through an action research mode of working -- working myself as a teacher, with friendly gestures of cooperating and getting cooperation, with informal meetings and casual talks -- that we finally got to a stage where we talked in a free and frank way like normal partners. Once we were at this stage, we were then unafraid to talk about our mistakes, we were comfortable in sharing our new ideas, and were enthusiastic in venturing to try narratives in new ways and also make programs such as science exhibitions, science experimental demonstrations, drawing and hands on activities, science room improvement activities and so on. Looking back to the study period, it seems that the success of the research approach was very much tied to the way the study was situated in the school contexts through an action research.

In fact, the idea of action research itself was an attractive concept for the teachers and the headmasters involved in this study. In my initial contacts with the teachers and the headmasters, I tried to brief my idea about how I could fit in their school as a participating teacher and researcher and how the school science teachers would participate in the research as partners. The teachers and the headmasters at that stage pointed out that such collaborations and cooperation would be nice to generalize to the overall

school context rather than only to science education. The Headmaster from Gandhi Adarsha was enthusiastic to get me involved in creating an overall atmosphere of teacher-teacher collaboration and teacher-community collaboration in the school. Keeping in mind my specific purpose at that time I had to tone down his ambition, saying that I could work only through the science classes, but would be glad to help the school endeavors in that direction. I also recall a moment with Mr. Purna who was Assistant Headmaster for classroom management and supervision, in Vishwoniketan. He had remarked that I did not even ask to arrange the class routine for my research convenience and was, in fact, helping them to adjust to their limitations. I replied that I wanted to be like any other teacher while in the school and that he should treat me accordingly. His comment was: "This is first time in our school somebody whether for research or for practice teaching, ever came with such an attitude."

I was happy to realize, as discussed in the Chapter 6, that the headmasters saw the benefits of the newly developed situation because of the action research approach whereby the teachers were starting to cooperate more in planning and also working closer with the students to conduct various school activities. In my last meetings with the headmasters, they were showing great interest in finding ways to continue the spirit of collaboration and cooperation among the science teachers and looking for possibilities to expand it to cover all the teachers. Certainly, bringing a more democratic, cooperative approach to school education was a new and attractive idea to the school community, and an action research approach seems to present a great potential for realizing such cooperation. Action

research program in general, would seem to offer great potential for reducing the hierarchical norms of school education in Nepal and for opening up the possibilities of cooperative planning and curriculum development.

Some Further Possibilities

Although the study was conducted with research questions that addressed many aspects of school education regarding the use of narratives in science teaching, there are some other aspects which were considered equally important but beyond the scope of this study. One such aspect which remains to be addressed is what types of narrative would have better promoted certain types of learning in science? It would have been possible to clarify narratives into cultural narratives, mythic-religious narratives, environmentally-based narratives, or even narratives based on the students home lives, and to investigate the effectiveness of each type of narrative. Would collections of the social and cultural narratives help as catalytic exemplars to provoke student's narratives or should teachers be more engaged in creating spontaneous narratives?

Some other aspects which emerged during the study period as attractive further research prospects were: What are the conditions under which narratives most naturally form part of the classroom discussions? How can narratives best enhance the capability of a teacher to gain access to the students' ways of thinking and learning and help to make their learning more interesting and useful? In other words how could the narrative approach be made a normal classroom activity for most teachers?

Martin (1990), has indicated how the use of one narrative to enhance understanding of a scientific concept helped students gain a better intuitive understanding of centripetal acceleration. This teacher narrative, as well as many of the narratives related in the present study, may well serve as conceptual anchors for the scientific concepts that form part of the curriculum. As evidence of this, the students were able to perform well in the examinations despite the fact that they were engaged more in narrative discourses than in textbook recitation. The notion of anchoring the learning of science concepts in the students' cultural or experiential background deserves further study.

Another interesting area of study relates to the possibility that the narrative approach to science teaching, which ties scientific explanations to many cultural and scientific beliefs, might help to remove student anxiety and the fears of . . . snakes "whose names should not be spelled", of monkeys that "one should not think about at night", and many other cultural beliefs that create nightmares among school children in Nepal. In this way, some of the negative consequences of the many cultural myths might be assuaged.

A Conclusion

I had proceeded to the schools in Nepal for my field study fully convinced that narrative approach to science teaching should be challenging as well as interesting in the real classroom situation. Challenging in that this was something very different from the traditional approach to current science teaching in Nepal, and interesting in the sense that for many people

in Nepal the telling, and listening to, of narratives occupies a very important place in their daily lives.

In the first introductory workshop seminar conducted to explain the ideas behind the narrative approach, the participants showed much enthusiasm as well as reservations regarding its compatibility with the current school teaching practices. The reservations were raised mainly because of the objective requirements of the traditional curriculum practices -- the way teachers were required to accomplish teaching of the contents as given in the textbook, the way examinations were conducted based on the text contents and language, etc. The enthusiasm on the other hand was the possibility of bringing something experiential, something embedded in personal consciousness guiding the natural conversations and perceptions, to the classroom discourses.

Currently, science teaching in the classroom mainly consists of reading the science textbook, and explaining and defining of the scientific terms by the teacher, and discussing the questions and answers important to the final examination. This has been dictated by the circumstances in which student satisfaction, parental satisfaction and the satisfaction of the school depend much on the examination results. In contrast, stories and other narratives occupy an important place in our society in Nepal -- story telling at home and in other social public places constitute important social activities. In the classroom also, a moment of talking about something the teacher and the students felt important in their real life was shown to give a respite from the tension of having to be formal: of reading the text, of preparing for the examinations that are conducted in the textbook language,

etc. Story telling sparked intense interest among the students, and the narrative discourses discussed earlier are full of passionate and committed participation by the students.

As mentioned in Chapter 2 there are now many philosophers, scientists, and science educators who are convinced of the power of personal narratives, personal convictions, and personal passions that can only be sparked through narratives, in developing and conducting scientific learning that lead to discoveries and other applications. Polanyi (1968) emphasized that what is known to a person cannot necessarily be expressed in their statements of spoken or written knowledge. Such personal knowledge comes out fragmented in bits and pieces and only in metaphorical language. The depth of individual knowledge from which natural inner understanding grows is not yet well-understood and used in the educational development of students. The main emphasis of this narrative approach was to let the students and the teachers explore such depths, self-directed as well as inter-personally to learn science in a more positive and fruitful way.

Martin (1990) has shown that personal narratives provide an effective basis of understanding scientific concepts and help to retain the understanding conceptual anchor in the memory. Jegede and Okebukola (1991) have pointed out the need to bring socio-cultural beliefs into science education to make learning more effective and Mahapatra (1991) has shown how such socio-cultural beliefs affect one's way of perception. The findings of the present study agree with the conclusions of these earlier studies and suggests that the use of the narrative approach to science teaching can help

interrelate students' experiences with the classroom and perhaps lead to sounder learning in science.

The narrative approach was effective generating enthusiasm in learning science in a more interesting and useful way. Student activities generated because of the narrative approach included student initiated science exhibitions, story telling sessions, student drawings and poetry. The inner enthusiasm with which the students participated was something previously unexperienced in Nepalese schools. The narrative approach seemed to create conditions under which students appeared to be willing to take much more personal responsibility for their learning. Further investigation of this possible effect of narrative approach to science education would be valuable.

As was the case with the teachers, the approach gave some initial anxiety to students as well because of the traditional examination system and the traditional way of fulfilling the school duties. However, such anxiety turned out to be unnecessary as the approach was able to address the traditional examinations. However, ways of alleviating such student anxiety earlier should be investigated.

Also, as is evident from the concerns shown by the head masters and the science teachers that there is a need to seriously reconsider the current requirements of school science -- the need to address the textbook contents and the need to prepare the students for the national level SLC Examinations. However, as it appears evident from this study, the narrative approach does appear to enable the students to perform well in the traditional examinations and also to engage in broader integrated activities of

discussing their personal understanding of the world, their hypotheses, and their salient experimentation, and also their zeal for activities.

In summary, the narrative approach to science education in Nepal has been shown to be promising, in a number of ways discussed above. Its greatest strength seems to be that a story telling, or story-sharing, mode of teaching, can be introduced into the classroom in a very natural, unobtrusive way, without interfering with the traditional goals of science teaching. Moreover, the narrative approach was shown to be highly interactive, and able to generate much student enthusiasm for science learning. Further studies would of course need to be carried out to generalize these results.

The narrative approach also came to mean more than story telling. It turned out that student poetry, student drawings, student projects and science exhibitions were other valuable ways in which students could "tell their stories."

Johnson (1976) discusses the ancient Greek myth of Amor and Psyche to stress how important it is to have a tower of faith in the journey of the human being through the world of desires and constraints towards achieving a life that would give us a feeling of fulfillment, inner peace, and a life worth living. In the story, Psyche loses her beloved god husband Eros and was expelled from the heaven. To regain Eros she was asked to perform four tasks set by Aphrodite: separating seed grains that were mixed to make it a more difficult task, getting golden fleece from impossible-to-catch mountain goats, getting a crystal goblet full of water from the dangerous river Styx that has no beginning or end, and getting a beauty ointment from the hands of Persephone, the ruler of the underworld. Through each different

stage she gets help mediated by Eros and finally succeeds in getting back to heaven. What is interesting in the story from an science education point of view is the need for Psyche to combine technique, information, and wisdom to solve her tasks. Science classes would be much more useful in our lives if they were to provide science's information and techniques combined with the wisdom such stories could bring. And in Nepal, there is no shortage of such stories.

References

Aoki, T. T. (1989). *Toward curriculum inquiry in a new key.* (Occasional paper, No. 2). Edmonton: Department of Secondary Education, University of Alberta.

Baird, J. R. (1986) Learning and teaching: the need for change. In J. R. Baird and I. J. Mitchell's (Eds.) *Improving the quality of teaching and learning: An Australian case study -- the PEEL project.* Melbourne, Victoria: Monash University Printery.

Bajaj, J. K. (1988). Franscis Bacon, The First Philosopher of Modern Science: A non Western View. In A. Nandy (Ed.) *Science, Hegemony and Violence: A Requiem for Modernity.* Tokyo: The United Nations University.

Bajracharya, M. B. (1978). *Mythological History of the Nepal Valley form Svayambhu Purana.* Kathmandu: Avlok.

Berg, T and Brouwer, W. (1991). Teacher awareness of student alternate conceptions about rotational motion and gravity. *Journal of research in science teaching.* 28(1), 3-18.

Bollnow, O. F. (1989). The Pedagogical atmosphere: The perspective of the child. *Phenomenology + Pedagogy,* Vol. 7, 5-76

Borgmann, A (1992). *Crossing the postmodern divide.* Chicago: University of Chicago Press.

Brouwer, W. and Singh, A. (1983). The historical approach to science teaching. *The Physics Teacher,* 21(4), 230-235.

Bruner, J. (1985). Narrative and Paradigmatic thoughts of knowledge. In E. Eisner(Ed.) *Learning and teaching the ways of knowing.* Chicago: The Chicago University Press.

Bruner, J. S. (1960). *The process of education.* Cambridge: Harvard University Press.

Bruner, J.S. (1971). The process of education revisited. *Phi Delta Kappan.*

Bybee, R. W. (1987). Science education and the Science-Technology-Society (STS) theme. *Science Education,* 71(5), 667-683.

Campbell, J. (1976). The masks of god: Oriental mythology.

Carnoy, M. & Samoff, J. (1990). *Education and social transition in the third world countries.* New Jersey, Princeton: Princeton University.

Carr, W. & Kemmis, S. (1986). *Becoming critical: Education knowledge and action research.* London: Falmer Press.

Carson, T. (1990). What kind of knowing is critical action research? *Theory Into Practivce,* XXIX (3), 167-173.

Carson, T. (1991). Pedagogical reflections on reflective practice in teacher education. *Phenomenology + Pedagogy,* 9, 1-12.

Carter, K. (1993). The place of story in the study of teaching and teacher education. *Educational Researcher,* 22(1), 5-12, 18

CBS (1992). Statistical Pocket Book. Kathmandu: CBS, Nepal National Planning Commission.

CERID (1988). *Activities for development of scientific measurements and computational skill at secondary school level.* Kathmandu: CERID, Tribhuvan University.

CERID (1989). *Factors affecting science teaching learning at secondary level schools in Nepal.* Kathmandu: CERID, Tribhuvan University.

Clement, J. J (1983). Students' alternative conceptions of mechanics. In J. D. Novak & H. Helm's (Eds.) *Proceedings of the international seminar*

on misconceptions in science and mathematics. New York, Ithaca: Cornell University.

Cleminson, A. (1990). Establishing an epistemological base for science teaching in the light of contemporary notions of the nature of science and how children learn science. *Journal of Research in Science Teaching,* 27(5), 429-445.

Connelly, M. F. & Clandinin, J. D. Stories of experience and narrative inquiry. *Educational Researcher,* 19(5), 2-14.

Couture, J-C. (1988). Action research in democratic decision making. In T. Carson and J-C Couture's (Eds.) *Collaborative action research: Experiences and reflections.* Improvement in Instruction Series, No. 18. Edmonton: Alberta Teacher Association.

Cunningham, L. J. and Gall, M. D. (1990). The effects of expository and narrative prose on student achievement and attitudes toward textbooks. *Journal of experimental education,* 58, 165-175.

Dibley, L. (1986). In Baird, J. R. & Mitchell I. J. (Eds.) (1986) *Improving the quality of teaching and learning: An Australian case study -- the PEEL project,* pp.86-97 Melbourne, Victoria: Monash University Printery.

Dobbert, M. L. (1982). *Ethnographic research: Theory and application for modern schools and societies.* New York: Praegar Publishers

Elliot, J. (1991). *Collaborative action research.* London: Open University Press.

Ellsworth, E. (1989). Why doesn't this feel Empowering? -- Working through the repressive myths of critical pedagogy. *Harvard Educational Review*, 59(3), 297-324.

Fensham, P. J. (1988). Familiar but different: Some dilemmas and new directions in science education. In Author's (Ed.) *Development and Dilemmas in Science Education.* New York: The Falmer Press.

Fenstermacher, G. D. (1986). Philosophy of research on teaching: Three aspects. In M. C. Wittrock's (Eds.) *Handbook of research on teaching.* (Third Edition, pp. 37 - 49). New York: McMillan.

Filmer, P., Phillipson, M. , Silverman, D., & Walsh, D. (1972). *New directions in sociological theories.* Cambridge, Massachusetts: The MIT Press.

Flood, J. (1986). The text, the student and the teacher: Learning from exposition in middle school. *The Reading Teacher*, 39, 784-791.

Freire, P. (1973). *Pedagogy of the oppressed.* New York: Seabury Press.

Gadamar, H. G. (1975). *Truth and Method.* New York: Seabury.

Garman, N. B. and Holland, P. E. (1989). Mcdonald and the Mythopoetic. A paper presentation, *The journal of Curriculum theorizing* Conference, Bergamo Conference Center, Dayton, Ohio. Oct, 18-21.

Gilbert, J. K. , Osborne, R. J. , & Fensham, P. J. (1982). Children's science and its consequences for teaching. *Science Education,* 66, 623-633.

Good, R. Herron, J. D., Lawson, A., & Renner, J. (1985). The domain of science education. *Science Education,* 69(2), 139-141.

Grundy, S. (1982). Three modes of action research. *Curriculum Perspective,* 2(3), 23 -34.

Habermas, J. (1972). *Knowledge and human interest.* Boston: Beacon Press.

Hammersley, P. (1990). *Classroom ethnography empirical and methodological Essays.* Philadelphia: Open University Press

Hebdige, D. (1988). *Hiding in the light.* New York: Routledge.

Hewes, D. W. (1990). *The boy who would be a helicopter -- the uses of story telling in the classroom.* Massachusetts: Harvard University Press.

Iser, W. (1974). *The implied reader: Patterns of communications from Bunyon to Beckett.* Baltimore: John Hopkins University Press.

Jegede, O. J. & Okebukola, P. A. O. (1991). The effect of instruction on socio cultural beliefs hindering the learning of science. *Journal of Research in Science Teaching* 28(3), 275-285.

Johnson, R. A. (1976). *She: Understanding feminine psychology.* New York: Harper and Row.

Judson, H. F. (1980). *A search for solution*, New York: Holt, Rinehart & Winston

Kemmis, S. & McTaggart, R. (1988). *The action research planner.* Victoria: Deakin University.

Kohli, A. (1989). *The state and poverty in India.* Cambridge: Cambridge University.

Kosmidou, C. & Usher, R. (1991). Facilitation in action research. *Interchange,* 22(4), 24-40.

Kromhout, R. & Good, R. (1983). Beware of societal issues as organizers for science education. *School Science and Mathematics,* 83(8), 647-650.

Kuhn, T. (1970). *The structure of scientific revolution.* Chicago: The University of Chicago Press

Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic Inquiry.* Beverley Hills, California: Sage Publications.

Lloyd, C. V. (1990). The elaboration of concepts in three biology textbooks: Facilitating student learning. *Journal of Research in Science Teaching,* 27(10), 1019-1032.

Mahapatra, J. K. (1991). The interaction of cultural rituals and the concepts of science in student learning: a case study on solar eclipse. *International Journal of Science Education,* 13(4), 431- 437.

Martin, B. and Brouwer, W. (1992). Science teacher education in STS. *Canadian Studies,* 27(1), 17-22.

Martin, B. and Brouwer, W. (1993). Exploring personal science. *Science Education,* 77(4), 441-459.

Martin, B. E. (1990). *Personal science and its implications for science education.* A doctoral dissertation thesis. Edmonton: Department of secondary education, University of Alberta.

Martin, K. and Miller, E. (1988). Storytelling and science. *Language Arts.* 65(3), 255-259.

McCutcheon, G. & Jung, B. (1990). Alternative perspectives on action research. *Theory into Practice,* XXIX (3), 144 - 151.

McRae, M. (1987). The Daedalus factor: Space age material replace the mythical wax and feathers in today's human powered vehicles. In *Equinox: The Canadian magazine of discovery.* No. 35, September/October, 80-95

Merken, M. (1984). *Physical science with modern applications.* Toronto: Saunders.

Merleau-Ponty, M. (1962). *The phenomenology of Perception.* London Routledge and Kegan Paul.

Merleau-Ponty, M. (1964). *The primacy of perception.* Edited by J. M. Edie. North Western University Press.

Miller, R. M. (1984). Science teaching for the citizen of the future. *Science Education,* 68(4), 403-410.

Mitchell, I. J. (1986). Establishing PEEL. In J. R. Baird and I. J. Mitchell's (Eds.) *Improving the quality of teaching and learning: An Australian case study -- the PEEL project* (pp. 18-27). Melbourne, Victoria: Monash University Printery.

MOEC (1985). School Curriculum: A historical perspective. *Education day 1985.* Kathmandu: National Education Committee, His Majesty's Government Nepal.

Naipaul V. S. (1990). *India: A million mutinies now.* Viking.

Nandy, A. (1988). Introduction: Science as a Reason of State. In A. Nandy (Ed.) *Science, Hegemony and Violence: A Requiem for Modernity.* Tokyo: The United Nations University.

National Education Commission(1992). *National Literacy Development Program.* Kathmandu: National Education Commission, HMG, Nepal.

Novak, J. D. (1966). The role of concepts in science teaching. In H. J. Klausmeier, Eds., *Analysis of concept learning*. New York: Academic press, pp. 239-254.

Novak, M. (1971). Autobiography and Story. *Ascent of the mountain, flight of the dove: An invitation to religious studies.* New York: Harper and Row.

Oja, S. N. & Smulyan, L. (1989). *Collaborative action research: A developmental approach.* New York: The Falmer Press

Participation and Equity Program (1987). *Listening to the past working for the future.* Victoria, Australia: Participation and Equity Program, Ministry of Education.

Polakow, V. (1985). Whose stories should we tell? -- a call to Action. *Language Arts,* 62(8), 826-35.

Polanyi, M. (1968). *Personal knowledge: Towards a post critical philosophy.* Chicago: The University of Chicago Press.

Popper, K. R. (1969). *Conjectures and refutation.* London: Routledge and Kegan Paul.

Posner, G. J., Strike, K. A., Hewson, P. W. & Gertzog, W. A. (1982). Accommodation of a scientific Conception: Toward a theory of conceptual change. *Science Education,* 66(2), 211-227.

Rahnema, M. (1990). Participatory action research: The "Last Temptation of Saint" development. *Alternatives,* XV 199 -226.

Roberts, D. A. (1988). What counts as science education? In P. Fensham's (Ed.) *Development and dilemmas in science education.* New York: The Falmer Press

Ruggiero, S., Minzoni, S. , Cartelli, A., Alighieri, S., Dupre, F., & Vicentini-Missoni, M. (1985). Weight, gravity, and air pressure: mental representations by Italian middle school pupils. *European Journal of Science Education,* 7, 181-194.

Schon, D. A. (1983). *The reflective practitioner: How professionals think in action.* New York: Basic Books.

Shrestha, K. N. (1988). The secondary education curriculum: Problems of anomalies. In M. P. Mainali & G. S. Shrestha, Eds., *Education and development.* Kathmandu: CERID, Tribhuvan University.

Sirisri, A. (1986). *A critical analysis of the junior high school science curriculum in Thailand.* Doctoral Dissertation Thesis. Department of Secondary Education, University of Alberta.

Smith, D. (1991). Hermeneutic inquiry: The hermeneutic imagination and the pedagogic text. In E. Short (Ed.) *Forms of curriculum inquiry.* Suny Press.

Spradley, J. P. (1980). *Participant observation.* Orlando, Florida: Holt Rinehart and Winston.

Swift, D. (1992). Indigenous Knowledge in the service of science and technology in developing countries. *Studies in Science Education,* 20, 1-28.

The Edmonton Journal, Feb. 27, 1993. p144

The Random house dictionary. (1966). p. 946. NY: Random House

The World Bank (1989). *Nepal policies for improving growth and alleviating poverty.* Washington D.C.: The World Bank.

UNESCO (1980). *UNESCO handbook for science teachers.* Paris: UNESCO

Vaidya, K. (1979). *Folk tales of Nepal.* Kathmandu: Ratna Pustak Bhandar.

van Manen, M. (1990 a) *Researching lived experience.* Ontario: Althouse Press

van Manen, M. (1990 b). Beyond assumptions: Shifting the limits of action research. *Theory into Practice,* XXIX (3), 151 - 157.

van Manen, M.(1991). *The tact of teaching.* New York: The State University of New York Press.

Vishwonathan, S. (1988). On the Annals of Laboratory State. In A. Nandy(Ed.) *Science, Hegemony and Violence: A Requiem for Modernity.* Tokyo: The United Nations University.

Vulliamy, G., Lewin, K. & Stephens, D. (1990). *Doing educational research in developing countries: Qualitative strategies.* London: The Falmer Press.

Watts, D. & Zylberstajn, A. (1981). A survey of some children's ideas about force. *Physics Education,* 15, 360-365.

Webster's New illustrated Dictionary. (1990). p. 865. Chicago: Ferguson.

White, R. T. (1986). Origin of PEEL. In J. R. Baird and I. J. Mitchell's (Eds.) *Improving the quality of teaching and learning: An Australian case study -- the PEEL project.* Melbourne, Victoria: Monash University Printery.

Yager, R. E. (1984 a). Defining the discipline of science education. *Science Education,* 68(1), 35-37.

Yager, R. E. (1984 b). The Major crisis in science education. *School Science and Mathematics,* 84(3), 189-198.

Yager, R. E. (1985). In defense of defining science education as the science/society interface. *Science Education,* 69(2), 143-144.

Young, B. L., Sands, M. K., Bowker, M. K., & Spencer, C. S. (1982). *Nepal secondary education project.* Kathmandu: The British Council.

Appendix I

A Brief Historical Account of Modern School Education in Nepal

Though unclassified as primary schools in the modern sense of the term, various religious institutions particularly Buddhist Biharas and Gompas and clandestine Hindu Gurukulas, have been teaching religious scriptures, religious philosophy, astrology, ayurveda (medicine), and some forms of general education such as reading and writing skills, mathematics, and economics. Generation and transmission of such knowledge and skills were accomplished through mentorship and apprenticeship among various groups of people organized clandestinely. The forms of the educational institutes as well as the way they run were not subject to contextual changes. They were exclusively available only to the caste wise upper class of people. Such institutes and modes of knowledge generation and transmission continue even today but in a continually declining trend. Several factors of modern day development contribute to the decline of the age-old system, and the single most important factor to bring such rapid change is the modern day education.

The year 1884 could be considered the formal beginning of modern day education in the contexts of narrow tracks of operating clandestinely organized educational institutes in the country. Jung Bahadur, the first Rana prime minister of Nepal, went on an official visit to Britain in 1850. Four years after his return he announced the opening of Durbar High School. As its name suggests, this school was a "palace" school. Housed in Jung Bahadur's palace premises, it would initially and for a long time thereafter enroll only the children of the ruling Rana clan and was taught by masters drawn from Britain and India. The school was organized on a British model and laid special emphasis on English language skill[1]. As the school was designed after the schools of England, the courses of study were heavily loaded with standard books of English[2].

It was only as late as 1910 that Durbar High School was formally declared open to the public. Even then, in all practical sense it was

available only for the privileged few of the time. It was only during the rules of the later Rana prime ministers -- after 1930 -- that some new schools (high, middle and primary) came to be established. In 1950 the number of primary schools throughout the kingdom of Nepal was 321.

After a long and arduous revolutionary movement by people, the autocratic regime of Ranas was finally pulled down from power in 1951. This event is considered the beginning of democracy in Nepal whereby the need of people in general became an issue of national concern. Since this time growth in number of schools became fast, and the growth was foreseen with a perception of social, political and economic development. By the time National Education System Plan (1971 - 76) was implemented the number of primary schools had hiked to 7275[3]. The plan was implemented by His Majesty's Government of Nepal in 1971. The overall objective of the plan was to give Nepal's education a new structure and a new dynamic. The new structure, it was stated, would help the education shake off its century old clerical orientation, meet national needs and aspirations, and contribute to national development efforts. The report (1992) of the National Education Commission has put the total number of primary schools in 1990 at 17842.

The language schools, started in the early years of the century, basically contained courses for literacy and numeracy. The modern type of primary schools (grade 1 to 5) that were patterned after Durbar School offered languages (English, Nepali and Sanskrit) arithmetic, social studies (history and geography) and drawing. With the exception of Sanskrit that is only a language for reading ancient scriptures like Latin and is used by the priests to conduct religious rituals, all these courses were prescribed in the syllabus applied in 1954. A course in hygiene and health also was later added to this syllabus. English, considered a foreign language and one of the causes that disrupted the old social order, was left out of this syllabus in the mid 60s but after about three years' experiment, English was re-introduced from grade three. Introduction of science whether as a subject or as content in other subjects is a very recent development.

The main objective of lower secondary (grade 6 and 7) education prior to 1951 was to help students acquire communicative skills in English.

The curriculum was designed to expose the students to arts (drawing) to a limited extent and to give them some opportunity to engage in sports activities. The revised curriculum in the decade of the 1950's aimed at imparting knowledge of science for the first time which also contained some fundamental knowledge about human physiology and personal hygiene.[4]

Courses of study for the secondary schools of Nepal (grade 8 to 10) were framed and adopted in Nepal for the first time in 1934 with the constitution of the School Leaving Certificate (SLC) Examination Board. The 1934 syllabus was language-oriented with English occupying the key position. More than sixty percent of the total marks were allocated to languages. Though language was heavily emphasized, Nepali was one of the elective subjects only. History and geography were two separate subjects covering twenty-five percent of the total marks. Mathematics was one of the compulsory subjects. Some major changes were made in 1952. Nepali became a compulsory paper. English remained to be the subject of highest degree of weightage. This 1952 curriculum also introduced science, rural economics, hygiene and physiology and occupational areas as optional subjects.

The Nepal National Education Planning Commission (NNEPC), formed in 1954, recommended for the planning of secondary education with new perspective. The NNEPC visualized secondary education as a strategy for social, economic and cultural development of a new democratic state. It recommended three main subject areas: common learning, vocational subjects and avocational subjects. Later, All Round National Education Committee made several suggestions for consolidating secondary school education. A new curriculum was designed by the National Education System Plan (NESP) in 1971 and it came into effect in 1972. The design of educational program isomorphic with national development was the main idea behind it. It recommended three streams of curriculum, one each for general, vocational and Sanskrit. Many phases of change have taken place since the first ever National Education System in 1970s, but the trend of changes remains a complex dynamics in which the social and modern-day developmental factors play major roles. Many

decisions are being made in the ways that would be considered nondemocratic and counter to the aspirations and sentiments of the general people, such as changing of science education from a compulsory to optional subject and making Sanskrit language education a compulsory subject instead of an optional subject.

---

[1] Regmi, V. N. (1992). *Policy for English Instruction in Primary Schools of Nepal: Past experiences and Future Directions.* Unpublished Document

[2] Sharma, G. N. (1980). *School curriculum in Nepal.* Ramshah Path, Kathmandu: Hem Kuti.

[3] CERID. (1984). *Determinanats of educational participation in Nepal.* Kathmandu: Author.

[4] CERID. (1985). *School Level Curriculum: A historical Perspective.* Kathmandu: Author

Appendix II

Glossary

—A—

Acharya: A highest degree conferred in Sanskrit Education

Aesop: Greek Author of fables, 600 B.C.

Aeshop Niti Katha: Aeshop's stories of conduct.

Ainselu jhadi: A bush berry.

Amla: A kind of small green fleshy fruit.

Amoebae: A micro organism that lives in water.

Annelida: A kind of longitudinal, round and segmented worm; earthworm.

Aphrodite: A character in greek mythology.

Ashadh: Third month of Nepali calendar.

Ashar: Ashadh.

Ashwina: Sixth moth of Nepali calendar.

Ason: The central commercial square in Kathmandu.

Ayurveda: A system of medicin and health therapy and a body of knowledge based on Buddhist and Hindu philosphies..

—B—

Babbar Mahal: A famous palace turned into a government department office.

Badamasharu: Bad guys. Problem creating kids (used in colloquial language sense).

Bagmati: The main river flowing across Kathmandu valley.

Baijani: Violet.

Bakhan: Nepal bhasha (Original Nepal language) word for story.

Bandar: Monkey.

Bhikchhus: Buddhist monk.

Biraalo: Cat.

Bishnu: An important hindu god, considered the supreme god by Vaishnava sect.

Bishnumati: Second important river flowing across Kathmandu valley.

Bokshi Daha: Literal meaning is witch pond. A natural pond in the Southwest Kathmandu valley.

Bokshis: Witches.

Brahmastra: Weapon supreme that can destroy a world, mentioned in Mahabharat. .

Byanja Nakegu: Literal meaning is rice feeding to frogs. Every year in the full moon of Nepali lunar calendar called Gunla, (corresponds to July) rice and food is offered to frogs in the rice field by the farmers in the Kathmandu valley.

—C—

CERID: Centre for Educational Innovation and Research Development, Tribhuvan University, Nepal.

Chahare: Also called **Chaturdashi**.

Chakka jam: Literal meaning is jamming the wheel. A popular form of political protest whereby the protesters would forcibly stop wheeled movement.

Charkoshe Jhadi: Literal meaning is four Kosh (1kosh = 2 miles) wide thicket. A longitudinal stretch of very thick forest in Southern Nepal at the foothills of the Siwalik mountain range.

Chaturdasi: Fourteenth day of the lunar calendar. The fourteenth day of the dark phase is important for different religious celebrations.

Chautari: A small stony perch or a square on the hillside trail where the travellers can take a plesant rest in the shadow of ver or pippal tree.

Chhedkhani: Witticism.

Chhidi: Ground floor, like a basement.

Chhuchundro: Shrew.

Chowk: Square. In Kathmandu valley houses are built side by side enclosing a rectagular stone or brick lined square shared by all the houses.

Chuleshi: A kind of Nepali kitchen knife.

—D—

Daedalus: A character from Greek Mythology who has flown to the sky using wings made of wax.

Dalit: Schedule caste in India.

Dantya Katha: Literal meaning is tootsy story. Collection of Fictitious stories.

Dasain: Also called Durga puja; Mohani Nakha in Nepalbhasa; National festival for worshipping Durga the goddess of power and destruction who overcame the evil powers to re-establish the rule of god.

Deimos: Greek Mythological character, a son of Mars.

Dewali: A special festival whereby all the kinsmen are gathered to celebrate common ancestral god.

Dhammapadath: A collection of Buddhist stories.

Dharma: Spiritual Moral.

Dhoti: A sheet garment worn like loose pyjama.

Door darshan: Literal meaning is television.

—E—

Eros: A greek mythological character.

—F—

—G—

Gai Jatra: Literal meaning is cows' procession. Processions with symbolic masks of cows accompanied by local music and chanting of sutras are held to commemorate those who passed away in the recent year. Cow is considered the only sacred living being devoid of sin and therefore able to cross the Baitarni, the vicious river seperating heaven from the other worlds. This is also a day of free and satirical speech, procession and enactment in the public places.

Ganga: Sacred river. Literally Ganga is the river flowing North to South from the Himalays across the eastern plains of India to the Bay of Bengal.

Gathanmuga Chahre: Fourteenth day of dark phase lunar calendar calenda.

Gathanmuga: Also called Ghantakarna. A mythical hero gatekeeper of Nepal Valley who provided safety to the the valley dwellers from all kinds of external evils including the mythical demons.

Ghoda ko lagam: Like the saddle of a horse.

Gobre Kira: Dung worm.

Gorkhapatra: The official daily news paper.

Grishma: Summer.

Guruba: Teacher.

Guruju: Priest.

Guthi: Social organization.

—H—

Hakucha: Blackie.

Hermeneutical: A way of interpretation of meanings based on historical and spatial contexts.

—I—

Indra: The god king of heaven.

Indra-dhanus: Literal meaning is Indra's bow. Rainbow.

Indrajatra: A very colorful festival in Kathmandu valley in August/September commemorating Indra.

Indreni: Rainbow.

—J—

Jal: Sacred water.

Janamahadyo: Literal meaning is the supreme god of people. A very popular god in Kathmandu. Janmahadyo is also called Matsedra Nath.

Jatak: A collection of Buddhist stories.

Jatras: Festival procession.

Jestha: Second moth of Nepali calendar.
Juwa: Gambling.

—K—

Kalash: Divine jar.
Kansutlo: Centipede.
Kartika: Seventh moth of Nepali calendar.
Katha: Story.
Kchhepyastra: Missile (Sanskrit).
Khamu: Two wicker baskets carried on sholdier balanced on a bamboo pole.
Khari Tree: A kind of tree.
Khasi: Castrated goat.
Khat: A ceremonial palanquine.
Koseli: Gift.
Kukur: Dog.
Kukur dahine: A kind of edible erchid plant.
Kurilo: Asparagus.
Kuwa: Shallow pond of water spring.

—L—

Lahari bhakha: A long tune for singing folk songs.
Lakchhana: Virtues.
Lal Hira: A colloquial for whatever.
Langurburja: A kind of Jackpot game.
Lok Katha: Folk tales.
Luto falne: Throwing out the measles.

—M—

Madhyama: Secondary level degree.
Magha: Tenth month of Nepali calendar.
Mahbharata: The great epic of war between the truth and the evil.
Mani: A mythical jewel on the head of Nagas.

Manma kura chha gadha gadha: In the heart is thought deeper and deeper.

Manohara village: A village by the side of Manohara.

Manohara: An important river flowing across Kathmandu valley.

Matshendra Nath: Another name for Janmahadyo.

MOEC: Ministry of Education and Culture.

Mohani Nakha: Another name for Dasai.

Muktak: Short lyrical poems.

Mula: Literal meaning is radish. Colloquial meaning is dude.

Muso: Mouse.

—N—

Naga raja: Mythical snake king.

Nakcchetra: The constellations along the lunar path.

Nakha: Festival

Namle Kira: Tapeworm.

Nanglos: A big circular plate made of bamboo strip used for winnowing rice and other grains.

Napadhne: No reading.

NCERT: National Council for Educational Research and Teaching.

Newari: Colloquial word for the original language of Nepal; **Nepalbhasha**.

NNEPC: Nepal National Education Planning Commission. The commission was constituted in 1954 to generate reccommendations for educational reforms based on the national needs.

Nyaurimuso: Mongoose.

—P—

Palpa: A district in the western Nepal.

Pan Ki: Silverfish.

Pancha Tantra: A very ancient collection of stories by Vshnusharman in five volume, 200 B.C. or old. A collection of animated short stories designed to teach different aspects of interpersonal relationships and witticism.

PEEL: Participation Equity in Educational Learning. The PEEL project of Australia reported in "Improving the quality of teaching and learning: An Australian case study."

Persephone: A character from Greek mythology.

Phobos: A character from Greek mythology, a son of Mars.

Planeria: A worm belongng to annelida class.

Platyhelminthes: A class of worm animals that have longitudinal flat bodies.

POE: A combined method of teaching Prediction Observation and Expectation.

Psyche: A charcter in Greek mythology.

Puja: Worship offering.

Pujari: Priest.

Purba Madhyama: Pre Secondary.

Pusha: Ninth month of Nepali calendar.

—R—

Rahu: A celestial demon trying to catch the sun and the moon. Solar eclipse takes place when it catches the sun; lunar eclipse when it catches the moon. In Astrology Rahu is an intercept between the heavenly orbital path of the Sun and the Moon. The other intercept 180degree apart is called Ketu.

Ram Navami: The ninth day of lunar calendar corresponding to the birthday of the popular hindu god Rama.

Ramayana: The epic of Rama's struggle with the evil.

Ranipokhari: A picturesque pool in the middle of Kathmandu made about 400 years ago by a King of Malla dynasty.

Ranivana: A pleasant garden forest made for queen.

Rashi: Zodiac.

Rastriya Nach Ghar: National Theater.

Rath: Chariot.

Rato Matsendra Nath Rath Yatra: The chariot festival of red Matsendra Nath.

Rudhibadi: Superstitious.

—S—

Sanglo: Cockroach.

Sarpa: Snake.

SEDEC: Science Education Development Centre. A centre of His Majesty's Government of Nepal, Ministry of Education to develop science education in Nepal.

SEDU: Science Education Development Unit. There are 25 focal units of Science Education Development Centre geographically distributed all over Nepal, each attached to a geographically focal school.

SEP: (National) Science Education Project undertaken by SEDEC.

Seto Matsendra Nath Rath Yatra: The chariot festival of white Matsendra Nath, a very popular festival in Kathmandu.

Shastri: The degree conferred to Graduates.

Shiva: A popular hindu god of Nepal.

Shraddha: Annnual commemoration of the passing away of close relatives.

Shramenera: Venerable senior Bhikchhu.

Shrawan: Fourth month of Nepali calendar.

Sithi: The monsoon festival of Kathmandu during which the wells are cleaned.

SLC: School Leaving Certificate.

SMT: Science Master Teacher, SEDU incharge who maintains SEDU facilities and conducts training.

Styx: A vicious river of Greek mythology.

Swanti Nakha: Also called Tihar is three day festival in commemoration of the godess of prosperity, Laxmi, the New Year of Nepal Era and the brothers' day when the sisters and brothers meet to bless and to feast.

Swasthani: A popular mythology about Shiva.

—T—

Tantra: Spiritual technique.

Tantrik: Master of Tantras.

Terai: A plain strip of land in the southern Nepal.

Thimeli: People from Thimi, a town in the eastern part of Kathmandu Valley.

Tiffin: Afternoon snack.

Tihar: *See* Swanti Nakha.

Tika: A color spot put on the forehead, considered auspicious by the Hindus.

Timi: You.

Trachea: Respiratory pipe.

—U—

Uttar Madhyama: Degree conferred to Post secondary education.

—V—

Vaidya: Ayurvedic Doctor.

Varsha: Rain.

Vayuyana: A vehicle that moves in the air; aeroplane.

Vedic: Originating from Vedas the holy scriptures of the hindus.

Vratta: A spiritual and divine vow.

—Y—

Yatra: Travel.

Yuva Manch: A magazine for children.

Appendix III

Participating Schools and the Teachers

Gandhi Adarsha High School

Gandhi Adarsha High School is situated in the suburban area surrounded by several agricultural villages. The school was established in 1953/54 by a very well known Gandhian social activist in Nepal Mr. Tulsi Mehr Shrestha. The school was upgraded to formal secondary level in 1961/62. The main intention of the establishment was to give vocational training based on Gandhian Principle. The focus was to help destitute women and the children of very low income group people gain self reliance. The school until very recent time used to provide formal school education in the morning and trades and vocations in the afternoon. Lack of funding, inadequate space/infrastructure and frequent changes of teachers appointed to the school by the central governmental authority acutely limited the functioning of the school continuously as a vocational school with a social mission. Gradually, the school turned into a normal public school. The school which was a part of the larger institute of Mr. Tulsi Mehr came under the direct authority of the education ministry since the implementation of National Education System Plan in 1974/75.

Current profile:

Total number of the students: 850
Classes run: Grade 1 to 10
Total staff members: 25
High School teachers: 8

Participating classes: Grade 7 and grade 8.

Grade 7 student number: 80
Grade 8 student number: 69
Average student presence: 85%

Participating teachers:

Headmaster: Bhai Raja Bajracharya

Secondary science teachers: Akhil Koirala
Primary science teacher: Surendra Shrestha (substitute teacher at the time)

Vishwoniketan High School

Vishwoniketan High School is now situated near a busy commercial spot in the urban Kathmandu. Established in 1947 by a social activist Mr. Narman Shrestha, it became high school in 1952/53. It had the first batch of students appearing SLC examination in 1955/56. The main intention of the school was to provide formal education to the people in general. The school has now expanded to include a Science Education Development Unit as well as an English teacher training centre.

Current profile:
Total students: 1700

Participating classes: Grade 7 and grade 8.
Grade 7 student numbers

7A: 78 **7B**: 72 **Total**: 150

Grade 8 student numbers

8A: 84 **8B**: 78 **8C**: 81 **8D**: 89 **8E**: 87
Total: 419

Average presence of students in the classroom: 90%

Total staff: 50

High school teachers: 32

Participating Teachers:
Headmaster: Mr. Gambhir Man Maskey
Secondary science teachers:
Uttara Shrestha
Gauri Khwonju
Kamala Shakya
Yeshodham Tripathy

Toye raj Paudel
Shanti Manandhar

Junior level science teachers:

Sushila Dahal
Laxmi Shrestha

A general description of the participants' other situations

The headmasters of the schools are senior teachers, having taught in the school for several years. They are socially connected to the establishment of the schools and are dedicatedly attached to the schools.

Mr. Bhai Raja Bajracharya has worked in Gandhi Adarsha High School since 1960 and has been appointed formally as the headmaster of this school since 1962. He has started his carrier as a school teacher since 1958. He had started in this school as a volunteer teacher and dedicated to the social mission of Tulsi Mehr. He is the first generation headmaster of the school and is now looking forward to retirement.

Mr. Gambhir Man Maskey started his teaching carrier as a school teacher in 1950s in Vishwoniketan. He is the fifth headmaster of the school appointed on the basis of seniori'y; the level of education, and the length of dedicated stay in the school combined. On the basis of on his age he was retired a couple year ago. But he was considered very much valuable for the school in terms of his dedicated contribution and the natural authority that he commanded and therefore he was requested to continue for another two year on contract basis, 1993 was the second year of this contract.

All the teachers, including the headmasters are under tremendous economic pressure. They all have to work more than one shift whether by working in small private business, or teaching in more than one school or private tuition, or taking care of family responsibilities such as family owned business or doing home chores in the case of female teachers. A typical successful science teacher would have one shift of teaching in a morning school, or colleges, or engage in private tuition, another shift of teaching in a day school, and the third shifts of teaching in an evening school or engage in private tuition. The regular class load for each of the science teachers in a regular day school ranges from 23 to 28 classes per

week. There are five and half working days per week, Sun day to Friday. Friday is the half working day.

Besides economic pressures, all the teachers are connected to the social obligations of having to contribute to the family economy, help each other in the family, and if she or he is prominent member, take the responsibility of looking after the others. Thus, the headmaster of Gandhi Adarsha has remained unmarried for the shake of upbringing of his four younger brothers and a sister because the parents suffered from permanent illness for a long time. The science teacher from that school is looking after the family needs now, his younger brother and sister are still studying and his father had passed away long time ago. His mother has been suffering from illnesses. A science teacher from Vishwoniketan has to take charge of her family after her brother passed away leaving behind his children in her care. Most female teachers also have their own home responsibilities that include kitchen responsibilities and the responsibilities of family businesses. In Nepal, kitchen is a serious responsibility because socially people are expected to prepare two main meals: one in the morning and one in the evening. A typical meal consist of rice, lentil soup and some curries, vegetable or meat, etc. Eating outside is neither looked at as something respectable and socially sensible thing to do nor it is economically viable. For the female teachers the social responsibility of looking after the need of household chores is rather seriously limiting factor.

A general description of the school situations

Both Gandhi Adarsha and Vishwoniketan have permanent buildings and provide rooms for all the classes. They also have some extra rooms for use as science room, vocational room, office, and store room. But the room sizes are mostly inadequate and inappropriate from the point of view that

-- they don't have lighting system
-- windows are without closing panes and are grilled with iron bars
-- there is no electricity connection in the rooms

-- benches and desks which are of long and narrow types hold four or five students in a limited space making it impossible for the students except read from one book placed on top of the others. The benches and the desks are also inadequate
-- benches and desks are fixed to the to the ground so that they are not easily destroyed by the moving here and there by the students, and limiting the possibility of alternative classroom arrangements
-- the toilets are without running water and so they are stinking problem during the summer time
-- there is no provision for safe and palatable drinking water

The provisions of classrooms are certainly better than many other schools in Nepal, but what is there do not seem adequately appropriate for many of the methods of science teaching that requires larger student-student interactions, science experiments. Even the demonstrations of science experiments by the teachers seem out of place in the situation. Given the situation the problems of the lack of science equipment and the instructional material become immaterial.